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Casts Hubs Entirely in Cores

Metal Poured Around Upset Ends of Spokes—No Flasks Required—Coremakers Set Cores During Pouring Time—Axle Holes Cast To Size and Cleaned with Grinding Wheels

BY H. E. DILLER

IT WOULD be impossible to define the word core as used in foundry practice in any short and concise way. From meaning a simple section to form a hole in the casting the term has been extended to include any piece, usually dry sand, which is inserted in a mold to form a part of the casting. More recently green sand has been in much greater evidence as a core material, and the core of half green sand and half dry sand has been introduced, this be-

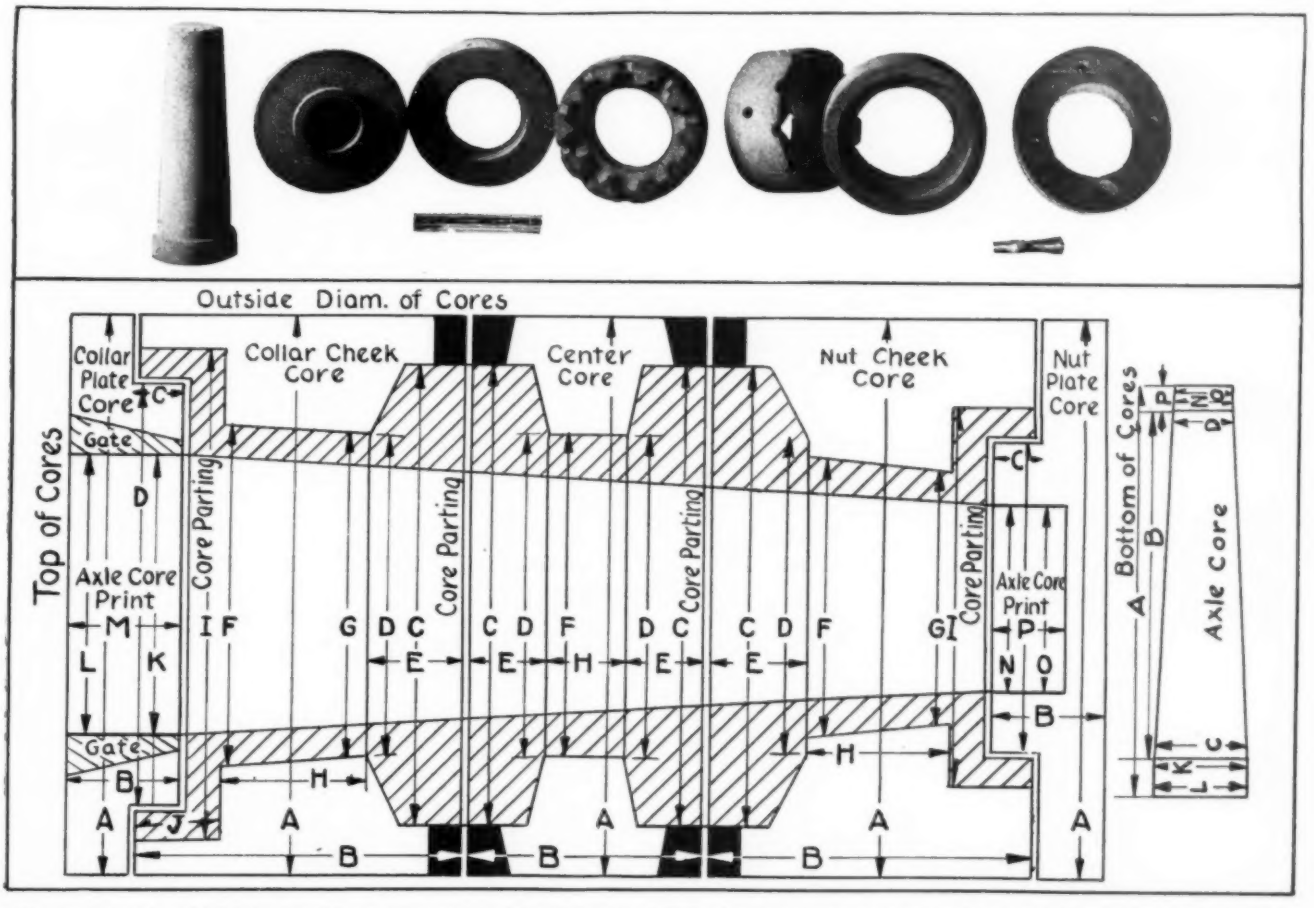


FIG. 1—SET OF CORES USED TO CAST A HUB, PLACED IN THEIR ORDER FIG. 2—ASSEMBLED CORES FOR A STAGGERED SPOKE HUB WITH COLLARS

ing formed with the dry section on the bottom to support the half made of green sand. Then from a simple piece or two set in a green-sand mold, this principle has been extended, as described in an article on the plant of the Lycoming Motors Corp. in the Oct. 1, 1922 issue of THE FOUNDRY, to include every portion of the mold except the container consisting of a drag flask lined with green sand.

The extreme to which the core has displaced the mold is indicated in the plant of the Geneva Metal Wheel Co., Geneva, O. Here the entire mold is formed of cores, without even the use of a flask, and the coremaker has entirely displaced the molder in one of the foundry departments operated by the company for casting iron hubs on steel wheels.

The problem may be understood better by referring to the drawing of a staggered spoke hub with collars shown in Fig. 2. As may be noted, the base of the assembly is formed by a flat core containing a print in which the axle core is set. As this end of the hub is the one against which the axle nut fits, the core is called the nut-plate core. In this particular case a core, known as the nut-cheek core is set above the plate core. This core requires a split core box.

The cheek core fits against the center core which is placed on top of it, and the two form openings through which extend the steel rods which form the spokes of the wheel. In the case illustrated, the center core is in one section and requires a corebox with a loose piece, as is explained later. Center cores also are made in two sections when it is found more convenient to do it this way. Above the center core is another cheek core known as the collar cheek core from the position in which it is placed at the end of the hub which fits against the collar of the axle. The final core is the cover core although in some places a second cover, or pouring core is used.

As may be noted a great many letters are placed on the drawing, Fig. 2. These serve to indicate dimensions which are written in a table included on the order sheet. Thus the dimensions of every core are marked on the order sheet and the man in charge of the pattern storage can select the proper core box in each instance. Thus the center core for one hub might serve for the center core of another hub which would require all the other cores to be different from those used for the first hub. Also a corebox may be fitted quickly for a job by a few alterations which would be cheaper than making a new box.

Sometimes a photograph is more understandable than a drawing, so the illustration in Fig. 1 may give clearer idea of the cores which make up a mold. The core at the left easily is identified as the axle core which fits into the print shown in the nut plate core next to it. The third core from the left is the nut cheek core, the side at the front fitting down over the plate core. The other side of this core is similar to the front of the fourth core from the left, which is a half section of the center core. The back of this piece is flat and fits against the other section of the center core shown at the right of it. It was deemed advisable to make this core in two sections on account of its length and because a hole for an oil line core had to be left in the side of the main core. This hole is shown in the illustration. The next core is the axle collar core, and the core farthest to the right is the cover core. As shown, this has four holes in the rim, the one larger than the others. This larger hole originally was the same size as the others, but was reamed out with the cast-iron instrument shown in front of the core. It is used for a pouring gate while the others serve to carry off the gases and act as flow-offs to the mold when it is poured.

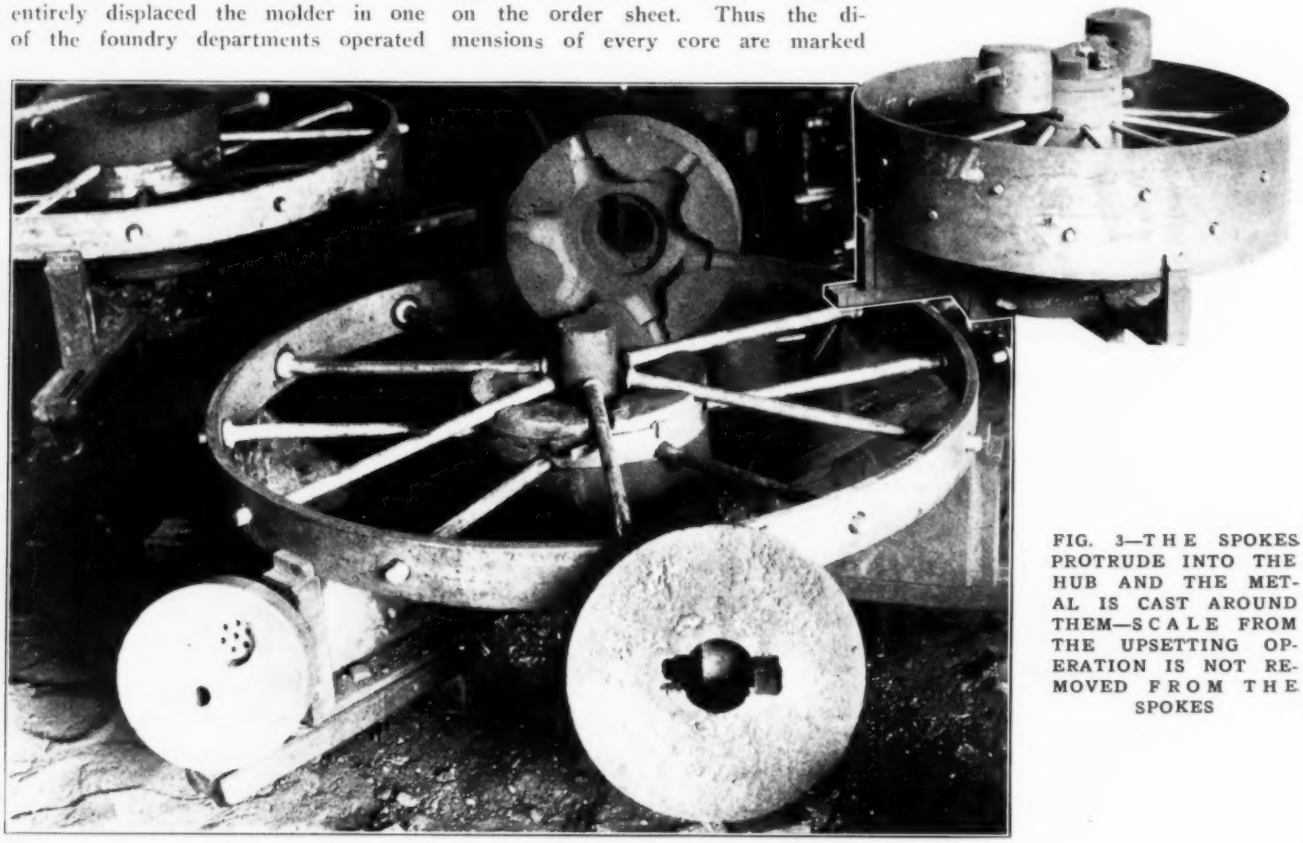


FIG. 3—THE SPOKES PROTRUDE INTO THE HUB AND THE METAL IS CAST AROUND THEM—SCALE FROM THE UPSETTING OPERATION IS NOT REMOVED FROM THE SPOKES

A mold in the process of being assembled as shown in Fig. 3, gives an idea of the relation of the spokes to the mold. The lower row of spokes has been set and the center core put on. As may be noted, this is in one piece and a band of light steel has been fastened around its circumference to prevent it from breaking when the metal is poured.

This mold is an example of the adap-

tation of an extra cover or pouring core. The regular cover core is shown standing on the floor at the right. The hole in it is a print for the axle core with two offsets formed into it for the pouring gate and flowoff. The core on the floor at the left is set above the cover core. This pouring core, as may be noted, also has holes for the down gate and flowoff, a strainer being placed in the hole for the down gate. Strainers are used only on hubs which have to be machined as in such cases a little slag in the hub would be highly detrimental, whereas if the hub does not require machining a small amount of slag in an occasional hub would not detract any from the usefulness of the wheel.

The views of the spokes, Fig. 3, show clearly the collar on the end against the rim and the flanged end around which the metal is cast. Both the collar and flange are formed by heating the rod and putting the end in an upsetting machine. This requires a heating for each end. Formerly, it was the custom to cold press an indentation in opposite sides of the end to be cast in the metal. However, the conditions under which agricultural machinery is now used, with a tractor instead of horses as the motive power, is more severe, and it has been found necessary to make the ends more secure in the casting, hence the necessity of upsetting the metal.

Hub Must Be Centered

The spokes must be secured mechanically because the metal of the spoke protruding into the casting is so large in proportion to the metal of the hub that the two do not fuse together and the end of the spoke must be of such shape that the metal setting around it will hold it firmly. The spokes are used as they come from the upsetting machine, the scale left on the heated portion evidently giving no serious trouble. However, if the end becomes rusted, the metal flowing against it is likely to blow. The difference between the action of scale and rust probably is due to the fact that the scale is an oxide while rust is partly a hydrate containing combined water.

Of course, in setting up the mold, it is essential that the hub be exactly in the center of the rim and that the collars on the spokes fit snugly against the rim. Also, the axle core must be truly perpendicular to a plane through the rim, and the hub must be at a definite height relative to that of the rim. To secure these adjustments a mechanism is provided, the portions of which are shown in Fig. 4. The pivot casting shown at *A* is bolted to a concrete block with four bolts, and is set so

FIG. 4—THE CORES ARE SET ON A CENTER PLATE OF A REVOLVING STAND WHICH HOLDS THE RIM AND SPOKES

that the machined hole in the center for holding the carriage of the machine is exactly perpendicular. The carriage shown at *B* sets in the hole of the pivot casting, revolving freely. The arms are machined accurately so that they all are of the same height, and supports for the rim are bolted to slots in the arms. These supports also are machined accurately and the rim fits snugly in the angle shown in the upper end of the supports. The plate *C* fits on the spindle in the center of the carriage and holds the mold. The height of this plate is regulated to suit each wheel by raising or lowering the spindle. This may be accomplished by turning the spindle

FIG. 5—CORES ARE BROUGHT FROM THE CORE ROOM ON A PLATFORM SUSPENDED FROM A CARRIER ON THE OVERHEAD TROLLEY SYSTEM

which is threaded into the center plate of the carriage. One side of the spindle is machined flat and a set screw in the collar shown against the center plate serves to lock the spindle in place when tightened against the flat section. When the correct height of the spindle is obtained, a templet sweep is used to bring all the arms to the correct distance. These can be moved in or out by unloosening the bolts in the slots and are then locked again before the molding begins. After the mold is set up, the weight shown at *D* Fig. 4, is placed on top of the cover core. This weight is made by casting on a steel rod a section flat on one side and having two indentations, one on each side. Also, two weights are cast on the rod, one on each side. The weight is set on the mold in a position which places one of the indentations in the center plate over the down gate. This serves to prevent the cores from being lifted with the pressure of metal when it is poured.

Probably it would be more correct to say core setting instead of molding as molding in the strict sense of that word is not used on this job. Cores are set on all the machines before pouring begins and after the pouring starts all the coremakers come to the foundry and set cores as fast as the wheels are poured. The metal sets quickly and the wheels can be lifted off the stands shortly after the metal is poured and a new mold set up.

The stands are arranged in double rows 50 feet long, with a gangway between them, and a track of an overhead conveyor system, made by the Louden Machinery Co., Fairfield, Iowa, operates above each row of stands. Five floors of double rows extend parallel to each other and a stock of spokes and cores is kept between the different rows so that the coremakers have the parts convenient when setting up the molds. Spokes and cores are brought to the foundry on a conveyor consisting of a flat platform held to a carrier by a chain fall attached to each end, as indicated in Fig. 5. Also buggies made for this purpose by the Sterling Wheelbarrow Co., Milwaukee, are used in special cases to carry the cores to the foundry.

The cores are made of a mixture of approximately 50 per cent old sand and 50 per cent new sand bonded with a mixture of pitch binder and a binder produced by the Robeson Process Co., New York. The sand knocked from the used molds is ground in a crusher secured from the Bonnot Co., Canton, O., and this crushed sand is mixed with new material in a mixer built by the Blystone Mfg. Co., Cambridge Springs, Pa. The sand is then carried to the coremakers' benches on an overhead trolley system like the one in the foundry. A special carrier has been built for this purpose. The upper part of the carrier is an oblong steel box attached to trolleys at each end, on the overhead tracks. The lower section of the box tapers down to an edge running lengthwise of the box in the center. One side of this sloping section consists of two doors. The doors are hinged to the upper section of the box and are allowed to swing out when the sand is to be dumped. Having two doors on the one side it is possible to dump only half of the sand when this is desirable.

The sand storage boxes at the coremakers' benches are arranged so they may be closed to prevent the sand

FIG. 6—A COMPLETE SET OF CORES ARE MADE ON A ROLLOVER-DRAW MACHINE—IT IS NECESSARY TO RAM INSTEAD OF JAR THE SAND FIG. 7—SOME CORES ARE MADE IN INDIVIDUAL BOXES

from drying out if kept in the box over night. This arrangement can be understood by referring to Fig. 7. The board *A* is hinged to the face of the box and when the molder is working is held up by the wooden block above it, which turns on a screw. At night this board is allowed to swing down and it then closes the outlet of the box. The top of the box is closed by the hinged cover shown at *B*, open and resting against the support in the middle of it.

This illustration, Fig. 7, also shows the equipment for making cores in a box. One section of the metal corebox may be seen on a cast-iron support in the center of the bench. The loose piece for forming the center hole is in front of it, resting with the print up, and the other half of the corebox is shown at the right. The core is rammed in the usual way for hand-rammed cores, struck off, and the drying plate, one of which is shown standing against the side of the bench is put on. The whole then is turned over and set on a plate for putting into the oven. The corebox, being split, is easily removed and the center loose piece is drawn out. The cores require careful ramming, especially along the edges, and a small rammer, as shown at the left on the bench, is used.

When an order is large enough to warrant, a set of boxes is mounted on a plate on one of the three rollover pattern-draw machines supplied by the Osborn Mfg. Co., Cleveland. One of these machines, equipped for making a complete set of cores for a mold is shown in Fig. 6. The set consists of two bottom cores, at the left; two center cores, above; and two top cores below. The patterns are aluminum, as are all patterns which are mounted by this company. The pattern for the center core is in two sections as both the upper and lower surface of this core must be corrugated to provide holes for the spokes. The center core in the middle section above is shown with the top section of the pattern set on, while the box for the center core, at the right, has the upper section of the pattern off. Similarly the top cores in the lower row on the plate are shown with the gate piece set on the pattern on in the center and off in the one at the right. The collars being short on this hub, no collar cores are necessary. The collars are formed in the top and bottom cores. When the cores are rammed and the bottom board clamped in place the whole is turned and lowered on the carriage guides underneath. The bottom board then is unclamped from the pattern plate which

FIG. 8—THE CUPOLA IS LIGHTED WITH A TORCH—NOTE THE CARRIERS ON THE MONORAIL FOR TAKING THE METAL TO THE FOUNDRY

is raised by the hand lever shown at the right of the machine. Rapping with a mallet, and the use of a vibrator, assist in giving a clean draw. The carriage then is pulled forward so that the plate with the cores easily can be lifted off. The cores are blacked only in cases where thin edges of core are so placed that enough metal flows around them to cause the sand to burn into the casting unless the surface is protected with blacking.

In addition to the rollover-draw machines, four machines made by the

FIG. 9—WHEELS ARE LAID ON A BENCH FORMED OF TWO CHANNELS IN PARALLEL AND THE AXLE CORES ARE KNOCKED OUT WITH A CHISEL

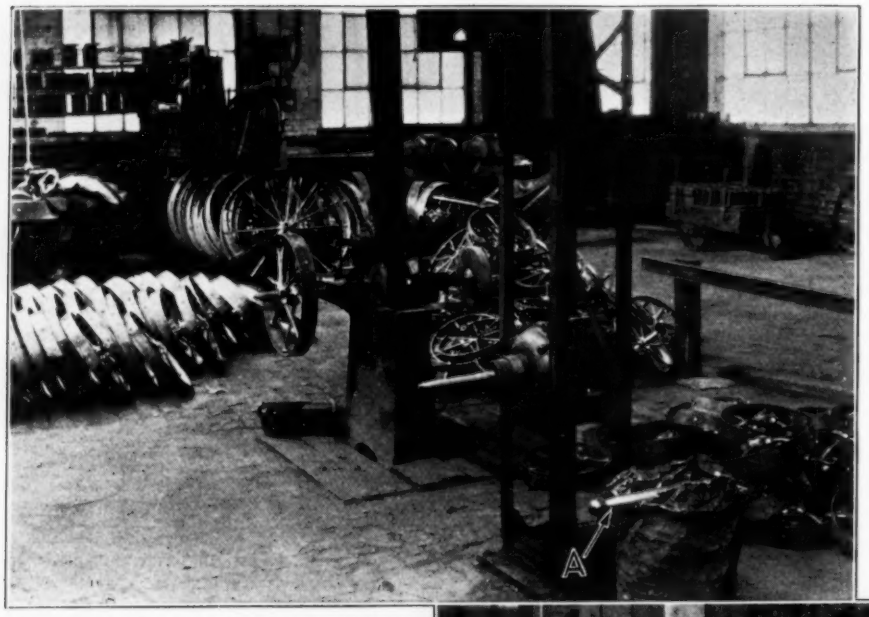


FIG. 10—SAND IS CLEANED FROM THE AXLE HOLES BY GRINDING

Wadsworth Core Machine & Equipment Co., Akron, O., have been installed. These produce straight cylindrical cores. All cores are baked in four shelf-type oil-fired core ovens built by the Foundry Equipment Co., Cleveland.

Along with the unique method of molding these hub castings, this shop uses some interesting methods in melting the metal and finishing the castings. The shop is laid out in a number of sections in a brick building with a monitor roof in the center of each section. The different rooms are heated by individual heaters equipped with electric motors and fans for circulating the heated air. The heaters were built by Robert Gordon, Inc., Chicago.

The room in which the dry-sand molds are poured is 100 x 108 feet, and the core room is 48 x 63 feet. Supplementing the facilities of these rooms, a section 48 x 70 feet is devoted to the production of hubs for disk wheels in green-sand molds. These hubs being for a disk wheel do not have spokes and are simply tube-shaped castings, slightly thickened at the center and tapering toward the end. A straight axle core is the only core used on this job which is made, 8 castings in a mold, on 4 squeezer machines. One of the machines was furnished by the Adams Co., Dubuque, Iowa, and the four others were supplied by the Osborn Mfg. Co., Cleveland. Beside the hubs, repair part

FIG. 12—RIMS ARE UPSET TO BRING THEM TIGHT AGAINST THE COLLARS OF THE SPOKES

FIG. 11—WHEELS ARE SET ON A SPINDLE SO THEY CAN BE TURNED FOR WELDING BLOW HOLES AND OTHER DEFECTS

castings also are made in green sand.

The cupola room which is connected to the other departments by the monorail system already referred to, is 21 x 48 feet. Two cupolas have been provided. The one is lined to 32 inches and the other to 30 inches. These are piped to a fan furnished by the B. F. Sturtevant Co., Boston. The mixture consists of pig iron and return scrap and sprue, no steel scrap being used. The first few charges weigh 500 pounds apiece and the latter charges are cut down to 400 pounds. The idea is to slow up melting toward the end. At the beginning of the heat, plenty of molds are ready for pouring as all the molds in the green-sand department are available. After these are poured, the metal can be disposed of only as fast as the molds

are assembled in the dry-sand department. This fact also requires a change in the pouring ladles used, for at the beginning of the heat, when plenty of molds are assembled and ready for pouring a 200-pound ladle is used, while near the end of the heat when enough molds are not always ready to take all the metal in the ladle a 150-pound pouring ladle is found to be advantageous.

Light Cupola With Torch

The cupola is lighted about an hour and a half before the blast is put on. An oil torch supplied by the Hauck Mfg. Co., Brooklyn, is used to heat the bed, as shown in Fig. 8. The metal is caught in a hand tilted mixing ladle placed on two trunnions. The ladle is equipped with a tea-pot spout made by molding clay around a steel ring at the top and extending it to near the bottom of the ladle. This must be renewed after each heat. It serves to prevent the slag from flowing into the pouring ladles, as the metal is taken from near the bottom of the mixing ladle. The pouring ladles are carried to the foundries on trolleys operating on the overhead monorail system. The trolley is connected to the ladle by a yoke attached by a wire to a drum operated by a hand wheel and gears. By this means the ladle can be raised or lowered to suit the mold it is pouring. A view of some of these carriers is shown in Fig. 8.

After the nubs are poured, the wheels are rolled to one section of the foundry. They are sorted and counted in the evening by three men who work independently, therefore, a correct count is assured.

From the foundry the wheels are rolled to the cleaning department, which is in one section of the machine shop. Here the wheels are laid on a bench made of two steel channels set parallel, 10 inches apart, and bolted to posts. A timber 3 inches high is bolted to the top of the channel and a ½-inch strip of steel is bolted on this. The idea of having the lumber between the steel is that it will absorb shocks. A wooden stand is built at each end of the bench and form convenient holders for the tools of the two cleaners who work at the bench. One end of the bench is shown in Fig. 9 which also illustrates one of the wheels, the hub of which was cast in the cores shown in Fig. 1. The collar and flange may be noticed at each end, and the extra distance between the two sets of spokes also is plainly indicated.

When the wheel is laid on the bench the core is knocked out of the axle hole with an air chisel, or at times a hand chisel is found more convenient. After the core is knocked out, the outside of the casting is cleaned with a wire brush. This is done easily as the sand does not burn into the metal. The company attributes this to the binder which is used.

The chisel does not entirely free the axle hole from all sand and it is necessary to use other means. Two spindle stands with grinding wheels on each end have been provided for this purpose. These are illustrated in Fig. 10. As may be noted on the grinder at the right, the wheels are fitted on a long spindle and are small enough in diameter that the spindle can be inserted in the axle hole of any hub. Wheels are placed on the spindle as shown on the grinder at the left and slowly turned around by the operator. When the largest wheels are to be ground the boards in the floor underneath the spindle are removed to allow the hub to be fitted on the spindle. Wheels weighing as much as 500 pounds are cleaned in this manner. The wheel on the other side of this grinder is used to grind the ends of hubs when necessary.

The axle holes are cored so accurately that machining for fit is not required, the grinding only being to clean out the last traces of sand, as has been stated. Of course, for agricultural implements, the fit need not be extremely close and a variation of 1/32 inch over size is allowed. However, when necessary to cast axles which will accommodate roller bearings, the hole can be cast close enough to size that it will require no machining. To accomplish this great care is taken with the core. The core boxes are machined as accurately as possible; then when the core is made the top half of the box is taken off and the green sand is dried in the drag half of the box. This cannot be used again until cool. Beside the care taken with the box, a special mixture of Michigan City sand with a small amount of old sand is used. This is riddled through a fine screen to secure a core of even texture. The correctness of the size of the hole is tested with an arbor, one of which is shown at *A*, Fig. 10.

Defective Spots Welded

Any blow holes or other defects in the casting which can be remedied by welding are repaired after the hub has been cleaned. For this purpose the wheel is set on a spindle, as illustrated in Fig. 11. In this position it can be turned readily to secure convenience in working. The oxyacetylene process is used for welding and serves to cut off the spokes in scrap wheels so that the castings can be returned as scrap to the cupola. When the welding is finished, the wheel is rolled to one of the two upsetting machines to have the rim pressed tight against the collars of the spokes. This operation is necessary because, while the collars of the spokes are set tight against the rim when the hub is cast, the shrinkage of the iron in the hub, as it cools, pulls the collars away from the rim. As may be seen from Fig. 12 this machine consists of a heavy steel ring inside of which are attached plunger heads, and inside of these are dies which form an almost continuous circle. These dies are built in sets of different lengths to accommodate wheels with a wide range of diameters. The largest wheel which the machine shown in the illustration will accommodate is 56 inches in diameter. To secure a more exact circle than is obtained with the dies shown in the illustration, a die composed of three sections of a circle sometimes is used. Close calculations are made to get the wheels of the diameter required and the wheels are upset slightly beyond the diameter required as the rims spring back a slight distance toward the original diameter after the pressure of the upsetting machine is released.

Spokes Are Upset

The machine is actuated by an oil pump operated by a motor. These are shown at the left, Fig. 12. A steel box for the return oil is shown between the machine and the pump.

The tenons, which is the name given to the end of the spokes beyond the collar, are upset individually on a machine built for that purpose. The sizes of these are accurately figured so that when upset the metal will either come flush with the rim or extend beyond as specified in the drawing. The tenons are upset cold. The steel in the spokes being low in carbon readily lends itself to this process. Wheels are dipped in a tank of asphaltum paint when finished and allowed to hang on a rack to dry.

The company operates a pattern shop in which all of the wooden patterns it requires are made. Also, a fireproof vault for pattern storage is provided. As may be judged from the class of work produced the foundry is well adapted to piece rate plan of payment and accordingly this is used almost exclusively.

The Dodge Sales & Engineering Co., Mishawaka, Ind., which for the past eight years has operated as the selling subsidiary of the Dodge Mfg. Co. and Dodge Steel Pulley Corp. has been consolidated with the parent company.

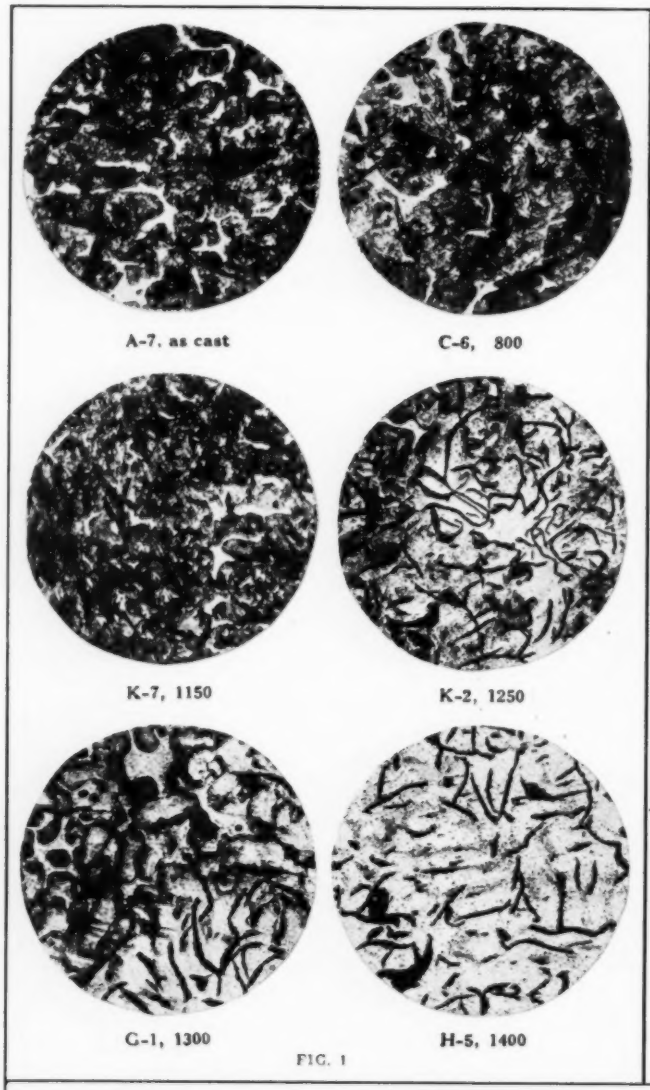


FIG. 1

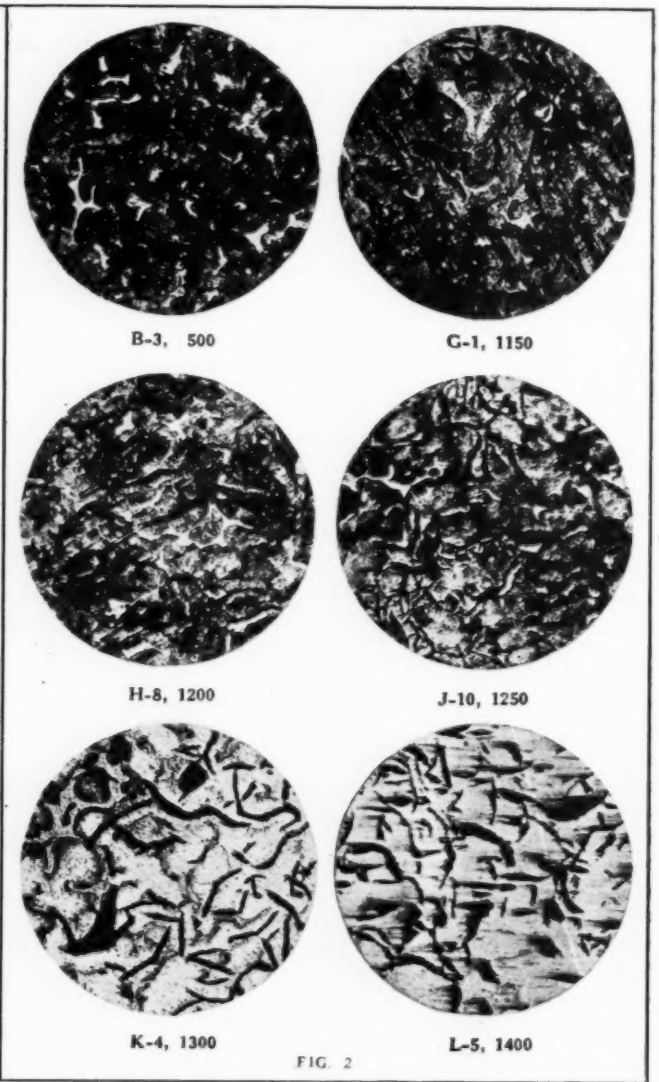


FIG. 2

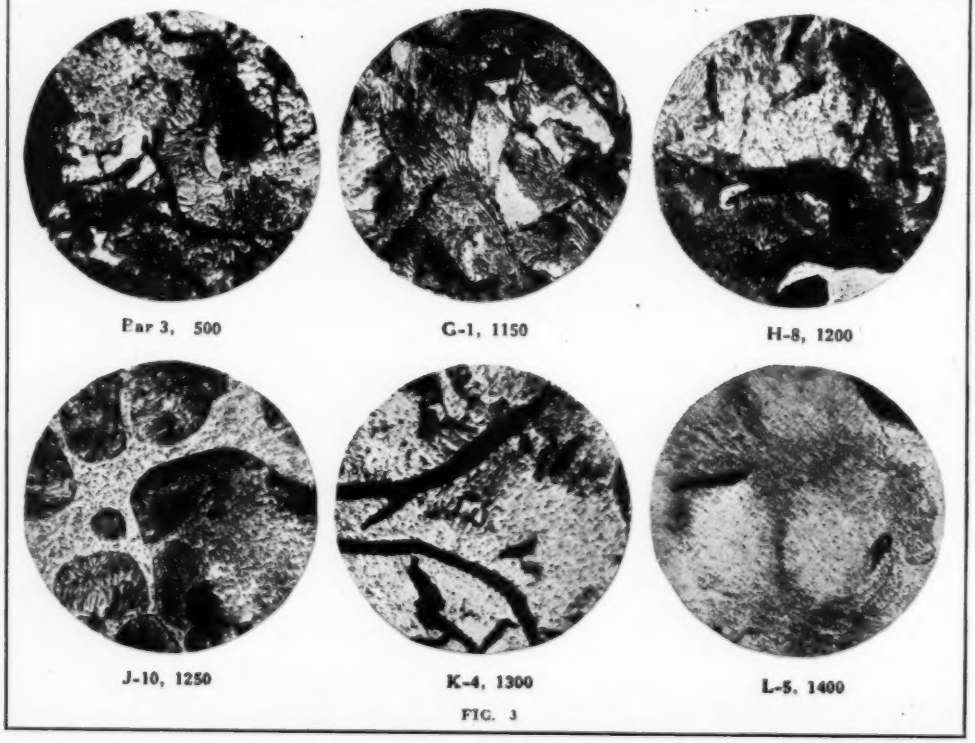


FIG. 3

FIG. 1—ABOVE, LEFT—MICROGRAPHS OF BARS ANNEALED FOR ONE HOUR
FIG. 2—ABOVE, RIGHT—SECOND SET OF BARS ANNEALED FOR ONE HOUR.
FIG. 3—LEFT—SAME AS FIG. 2, MAGNIFIED 400 DIAMETERS

Effect of Annealing Gray Iron

Test Bars Heated at Different Temperatures for Various Lengths of Time Show Changes in Strength and Hardness Caused by the Annealing—Results Charted and Micrographs Shown

BY J. F. HARPER AND R. S. MAC PHERRAN

THE investigation discussed in this paper was conducted by the Allis-Chalmers Mfg. Co. to determine the correct time and temperature for annealing gray iron castings, as well as to determine the effect of annealing and quenching on the physical properties. Each set of test bars was cast from the same 3000-pound ladle, five transverse bars, 1 x 2 x 26 inches, being cast in each flask. When breaking several bars at a given temperature, only one bar was taken from any one flask. This was done to average the casting conditions.

Brinnel and scleroscope tests were made on a ground surface of transverse bars near the fracture, or on a ground surface of the threaded end of the test bar when only tensile bars were broken.

The transverse bars were 1 x 2 inches and 24 inches between centers. The tensile bars were cut from transverse bars after fracture, and were taken longitudinally, and adjacent to the fracture. The tensile bars were made with threaded ends, and were ground to 0.564 inch for a space of 2 inches in the center part of each individual bar

The furnace used for heating was of the semimuffle oil-fired type and was equipped with a potentiometer-type pyrometer system. For annealing purposes test bars were held at the maximum temperature for 1 hour, and cooled in the furnace. The combined carbon was determined by color and only used as a check.

All specimens for micrographs were etched with picric acid, and all micrographs, unless otherwise stated, are shown at 110 diameters.

The results of annealing for one hour on the first set of bars as shown in Fig. 5 would indicate that up to 1150 degrees Fahr., there has been no loss of strength. Apparently there is a slight drop in the scleroscope hardness, but no change in the brinell hardness until 1200 degrees Fahr. is passed. These results are confirmed by the change in combined carbon. Representative micrographs were taken from these bars as indicated by group letter, flask number and temperature of annealing, given under each micrograph. These are shown in Fig. 1.

It may be noted that no decided

Paper prepared for the Rochester meeting of the American Foundrymen's association.

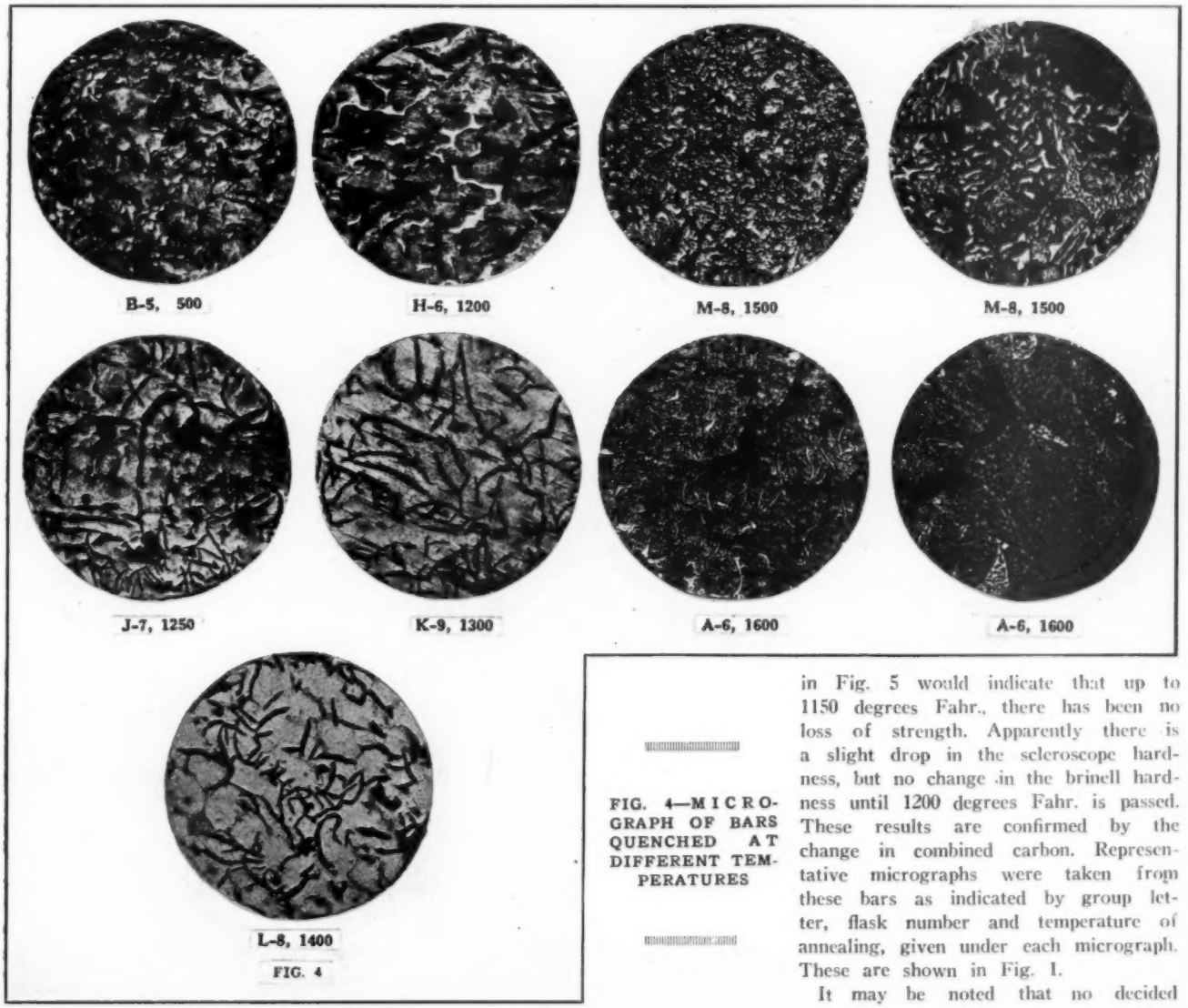


FIG. 4

FIG. 4—MICROGRAPH OF BARS QUENCHED AT DIFFERENT TEMPERATURES

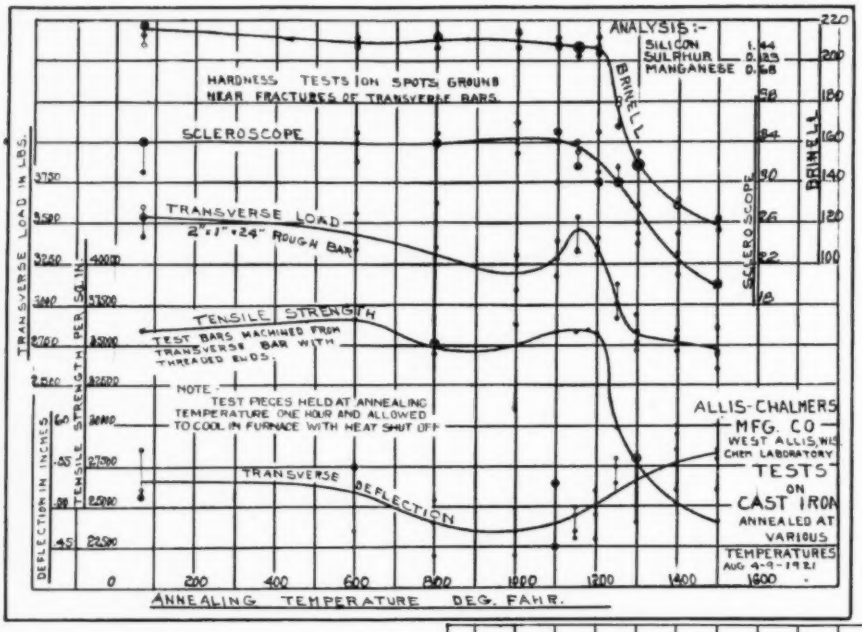


FIG. 5—AT THE LEFT—PHYSICAL TESTS OF BARS ANNEALED ONE HOUR

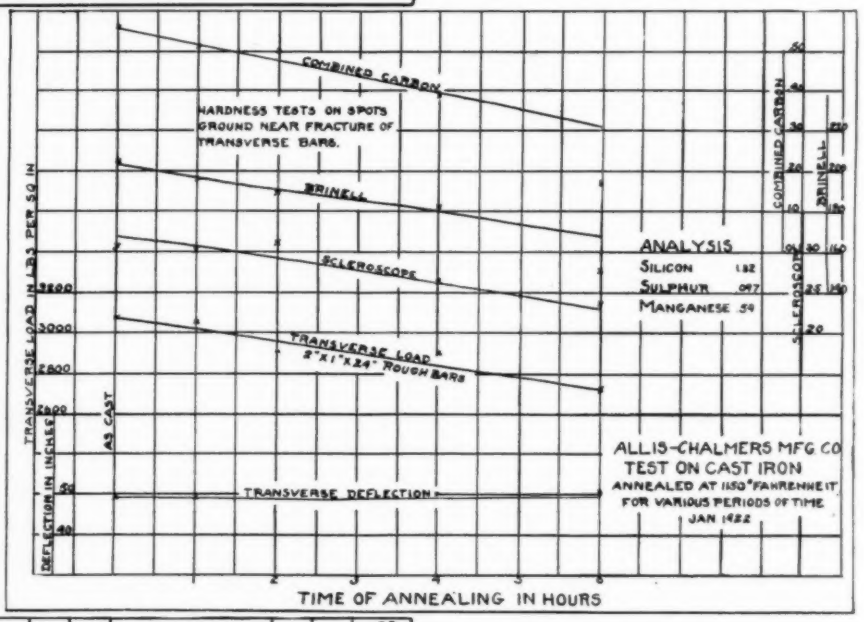


FIG. 7—AT THE RIGHT—TESTS ON BARS ANNEALED DIFFERENT LENGTHS OF TIME

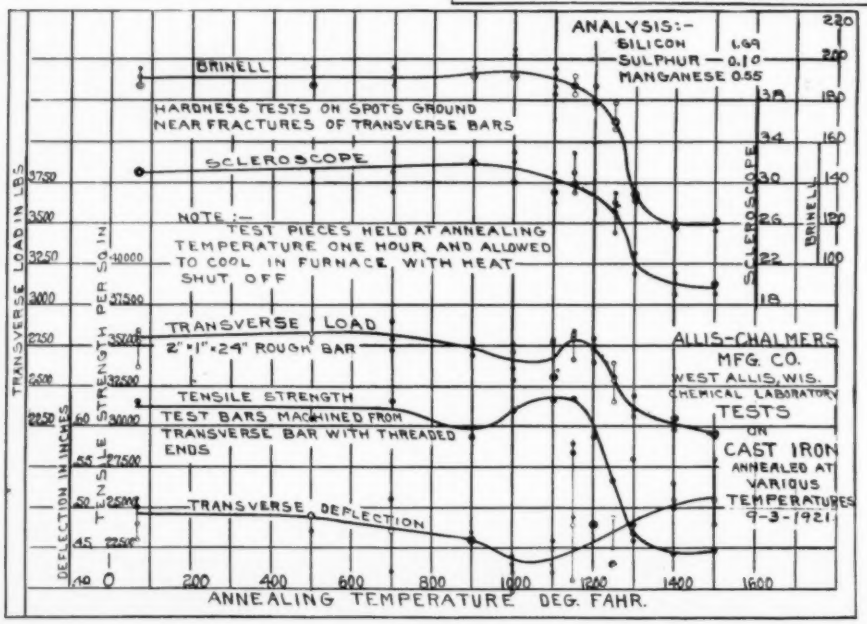


FIG. 6—AT THE LEFT—ANNEALED BARS LOSE NO STRENGTH AT 1150 DEGREES FAHR.

grees Fahr. nor material decrease in brinell and scleroscope hardness at this temperature.

At 1250 degrees Fahr. there is a slight drop in physical properties, as well as in hardness. These results are again confirmed by a decrease in combined carbon.

Representative micrographs were taken from these bars and are shown in Fig. 2. A slight change may be noted at 1200 degrees Fahr. followed by a decided change at 1300 degrees. This is again progressive, and at 1400 degrees is practically complete. These changes are shown in more detail in Fig. 3, where the same bars are shown at 400 diameter magnification.

change had taken place until a temperature of 1250 degrees Fahr. was reached. (Bar K-2). This change is progressive as temperature increases until at 1500 degrees Fahr, it is practically complete. There also appeared to be a tendency of the graphite flakes to enlarge.

The results of annealing for a period of 1 hour as shown in Fig. 6 would indicate no loss of strength at 1150 degrees Fahr. (for 1 hour) should not be ex-

To determine the element of length of time of annealing, the tests were made as shown in Fig. 7.

From Figs. 5 and 6 it would appear that the temperature of 1150 degrees Fahr. (for 1 hour) should not be ex-

ceeded when annealing to relieve machine or casting strains. In Fig. 7 is clearly shown the effect of continued annealing at this temperature. It may be noted that there is a material loss of hardness and strength on the longer

FIG. 9—AT THE RIGHT—TESTS OF BARS QUENCHED AT VARIOUS TEMPERATURES

periods of time at this temperature.

Fig. 8 shows the effect of annealing at 1050 degrees Fahr. for various periods of time. This would indicate that this temperature of annealing for reasonable periods, does not tend to decrease materially the hardness or strength.

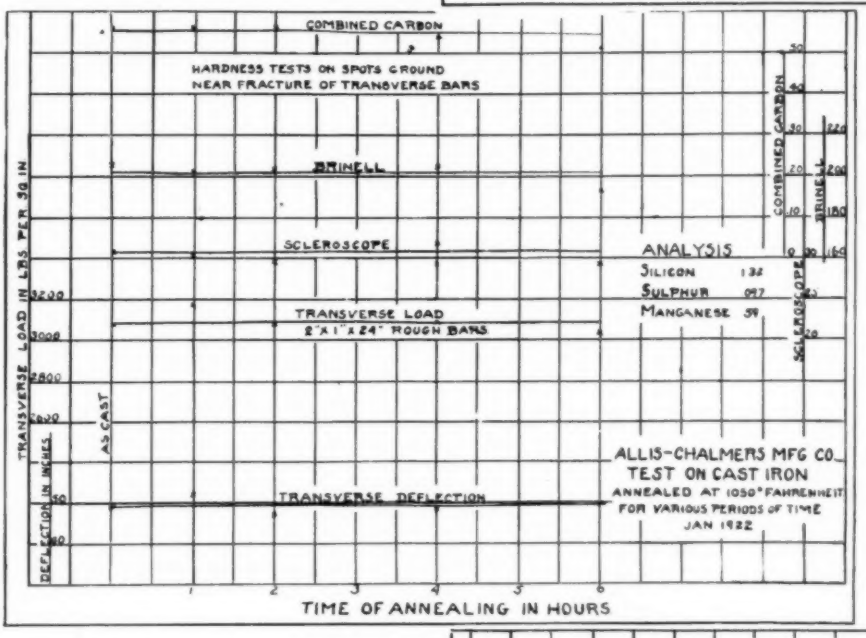
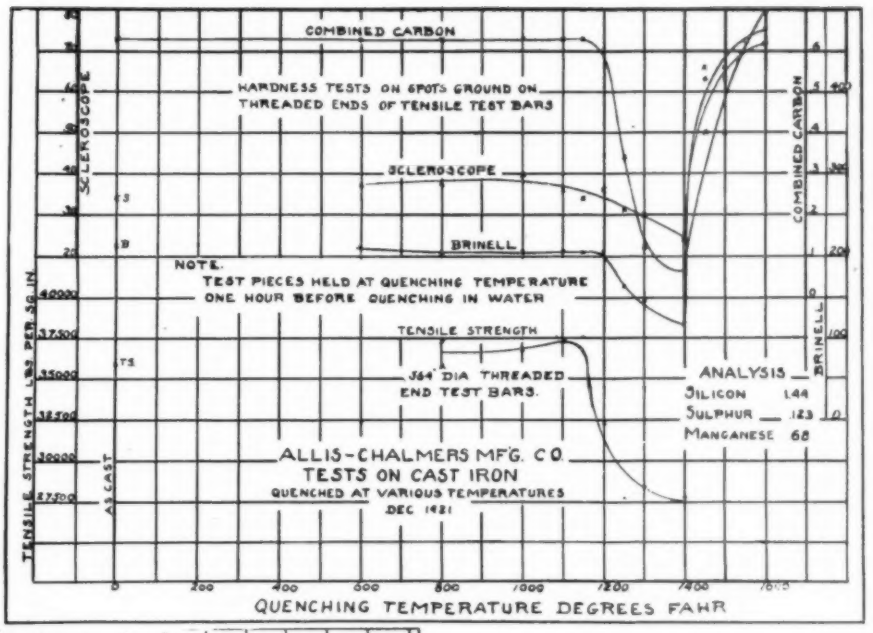


FIG. 8—AT THE LEFT—TESTS OF BARS ANNEALED AT 1050 DEGREES FAHR.

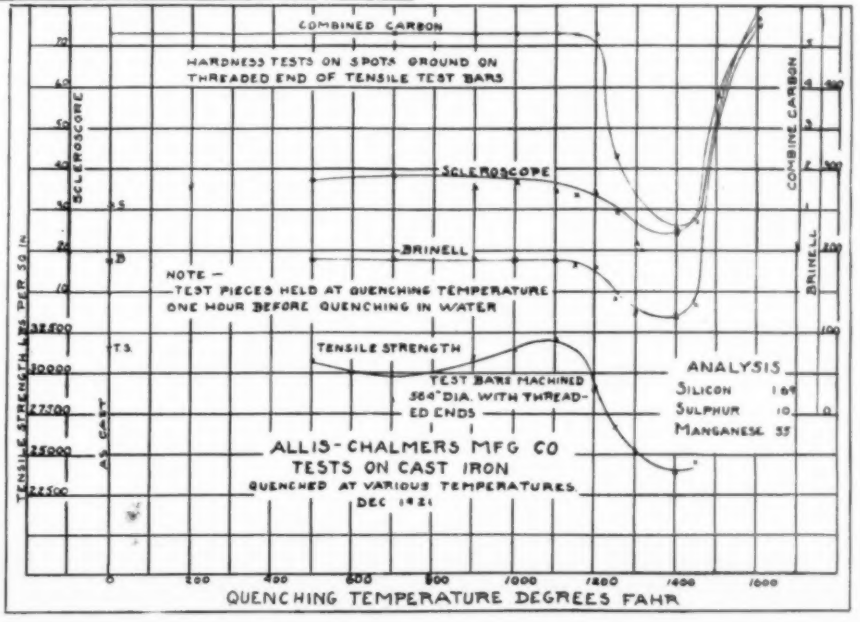
When annealing to increase machineability, only temperatures of from 1450 to 1550 degrees Fahr. will be found satisfactory. However, in this case, it should be noted the drop in hardness is accompanied by a decided loss of strength.

FIG. 10—AT THE RIGHT—QUENCHING AT ABOUT 1200 DEGREES LOWERS STRENGTH

The following experiments were made on the effect on cast iron of quenching at various temperatures.



In Fig. 9 the bars were held at the quenching temperature for 1 hour before quenching in water. It should be noted that above 1200 degrees Fahr. the brinell hardness falls off until 1400 degrees Fahr. is reached, above which it rises rapidly. The fall in scleroscope hardness is less abrupt, but both in decline and increase follows the brinell test. The tensile strength falls off above 1150 degrees progressively until 1400 degrees is reached. When quenched above



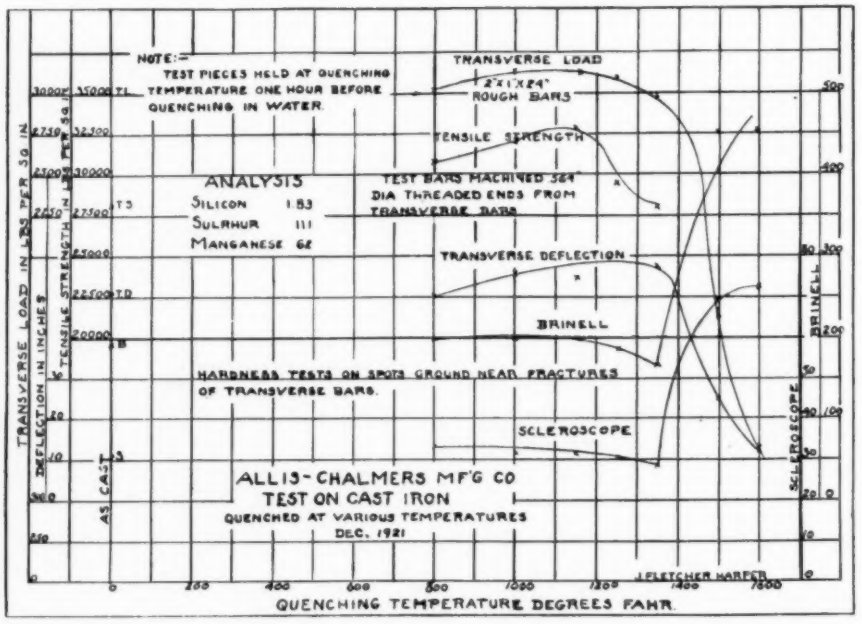


FIG. 11—TESTS MADE TO CHECK RESULTS REPORTED IN FIGS. 9 AND 10

this temperature the bars were too hard to machine. The combined carbon begins to diminish at 1200 degrees which change continues progressively until over 1400 degrees, when it again rises rapidly.

The test bars were cut from the broken transverse bars reported in Fig. 5, no bar being heated for these tests to a higher temperature than was given it in the tests.

In comparing results in Figs. 9 and 5, the close agreement should be noted between the properties of the bars in these tables heated to the same temperature. This agreement continues up to 1400 degrees Fahr., above which temperature the carbon in the quenched bars seems to be partly dissolved and held in this condition by the quenching with a consequent increase in hardness.

The test bars reported in Fig. 10 were cut from the broken transverse bars shown in Fig. 6 and were quenched in water after holding at quenching temperature 1 hour.

It should be noted that above 1200 degrees Fahr. the brinell hardness falls off until 1400 degrees Fahr. is reached, above which it increases rapidly. The change in scleroscope hardness again follows the brinell test. The tensile strength begins to show a decrease at 1200 degrees, which continues until 1400 degrees is reached. When quenched above this temperature the bars become unmachinable. The combined carbon seems to confirm the above tests.

In comparing results in Figs. 10 and 6 the agreement should again be noted between the properties of the bars in these charts, which were heated to the same temperature. This agreement continues up to 1400 degrees Fahr. above which, as in Figs. 9 and 5, quenched bars become very hard, due probably to some of the carbon being dissolved, and held in this condition by quenching.

This also is shown in micrographs in Fig. 4. These show a breaking up of the carbides at temperatures above 1200 degrees Fahr. which change is practically complete at 1400 degrees Fahr. When quenched above this temperature the carbon is partly retained in solution with resulting increase in hardness. An interesting comparison is shown between micrographs in Figs. 2 and 3 and those of Fig. 4.

For Fig. 11 a set of bars was cast to check those in Figs. 9 and 10. The results agree well. A continued drop in transverse strength above 1400 degrees Fahr. is due to the brittleness of the material.

From the results of these tests it would seem that until the temperature exceeds the critical the rate of cooling has no effect on the physical properties of cast iron.

Safety Meet in Buffalo

The National Safety council has accepted the invitation of the Buffalo chamber of commerce to hold the 1923 National Safety congress at that city, Oct. 1 to 5, according to announcement by W. H. Cameron, managing director for the executive committee of the council. Because of the increasing importance of the national problem of accident prevention, this year's congress is expected to be the best attended in the history of organized safety. Over 3000 delegates gathered at the 1922 convention at Detroit.

British Plan Welcome for Foundrymen

Preliminary plans are being made in London for active co-operation between the Institution of British Foundrymen and the American Foundrymen's association in connection with the international foundrymen's congress and exhibition which will be held in Paris in September under the auspices of the French Foundrymen's association. It is expected now that a delegation of American foundrymen will arrive in England late in August. After spending a few days in Great Britain this delegation will join the representatives of the Institution of British Foundrymen in London and proceed with them to Paris just prior to the opening of the French convention which starts Sept. 12. The American delegation will be received officially in Great Britain by various branches of the Institution of British Foundrymen and by other prominent British metallurgical societies.

A subcommittee on arrangements has been appointed of which H. L. Reason, president, and Oliver Stubbs, president-elect of the Institution of British Foundrymen are joint chairmen. The other members of this committee include W. G. Hollinworth, general secretary I. B. F., Wesley Lambert, Col. W. F. Cheesewright, V. C. Faulkner and H. Cole Estep. This subcommittee will operate under the direction of the full committee on International Relationship recently appointed by the general council of the Institution of British Foundrymen. The full committee consists of the president, senior vice-president, junior vice-president, president of each branch, general secretary, Col. W. F. Cheesewright, V. C. Faulkner and H. Cole Estep.

A London committee on entertainment of American Foundrymen has also been formed. This committee consists of Wesley Lambert of J. Stone & Co., Ltd., Deptford, London, president of the London branch of the Institution of British Foundrymen, chairman; G. C. Lloyd, secretary, British Iron and Steel Institute; G. Shaw Scott, secretary, British Institute of Metals; W. G. Hollinworth, Col. W. F. Cheesewright, V. C. Faulkner and H. Cole Estep. It is probable that after the Paris convention, arrangements will be made for an Anglo-American party to visit certain important industrial and historical districts in France, Luxembourg and Belgium.

Selling Goods for Uncle Sam

Immense Stocks of War Materials Ranging from Airplanes to Kitchen Forks Disposed of Through Modern Merchandising Methods —Metals Formed Important Item

BY MAJ. JAMES L. FRINK

SOON after we declared war on Germany, the far-seeing mind of the general staff of the army began a consideration of the ways and means of liquidating surplus supplies which were bound to accumulate. The result of this foresight has been the reclaiming of approximately $1,000,000,000 for the treasury, and the saving of several hundred million more.

In May, 1918, congress first authorized the President, in his discretion, to sell such surplus materials as might accumulate. Two months later the President's powers in the disposal of surplus property were considerably broadened. These dates are of first importance, because of their indication of the fact that even in the midst of war the department charged with the defense of the nation was preparing for peace. They also indicate the sound judgment displayed by the war department in anticipating conditions, which resulted in the so-called "buyers' strike" in 1920.

Early sales made between the date of passage of the first emergency legislation regarding surplus property and January, 1919, were supervised by a committee of the war department general staff under General Goethals, and amounted to some $123,000,000. Soon after the signing of the armistice, the amount of business became so great that it was impracticable to handle it longer through a committee, and accordingly, in December, 1918, a sales branch was established under an official designated as the director of sales, whose duties may be defined briefly, as follows: To formulate, supervise and co-ordinate the selling of surplus supplies, material, equipment, by-products thereof, buildings, plants, factories or lands embraced within the Act of Congress approved July 9, 1918.

At the time of the establishment of the office of the director of sales, estimates of the probable total amount of surplus that would eventually result from demobilization and the decreased requirements of the permanent peace-time military establishment varied between two and three billion dollars. The surplus consisted of an almost untold variety of articles. The quartermaster corps alone listed more than 65,000 separate items exclusive of transportation and real estate. The grand total of items listed by all services ran over 100,000.

MAJ. JAMES L. FRINK

Classification of Property

Major classification of property included airplanes and electrical equipment; animals; building materials; chemicals; clothing of every description, including millions of uniforms, underwear, socks, hats and other articles; solders' equipage, such as canteens, cups, knives and forks, haversacks, tin hats; electrical equipment, ranging from small fuses to complete power plants worth a million dollars each; metals, ferrous and nonferrous; fuel; hardware; land and buildings; leather; lumber; machinery and engineering equipment, ranging in size from a small pocket compass to the largest cranes built; machine tools; medical and hospital supplies; motor vehicles; animal-drawn transport and equipment; office and household equipment; railway materials and rolling stock; floating equipment, from small row boats to the largest ships; ammunitition; foods; textiles and wool.

The large quantities of surplus held in these various classifications presented a liquidation problem filled with difficulties and fraught with danger, not only to the public welfare but to that welfare's never-failing barometer—our national commerce and industry. Various liquidation plans were put forward, some enthusiastic and well-meaning gentlemen with limited knowledge of economics even going so far as to seriously suggest the entire surplus being dumped into the sea.

The folly of any such procedure as this brings to my mind a remark made recently by the secretary of war in an address before the Newark chamber of commerce, in which he stated "the truth is that we must recognize that property is not created for despoilment, but for the welfare of humanity and that it must receive the protection of organized governments and all classes of citizens or progress will cease." While this remark of the secretary's was not made in relation to surplus property, it shows why the war department would not consider the absolute destruction of such a large quantity of material.

Another plan put forward and which received serious consideration was what is commonly known in commerce as "dumping," that is, throwing the entire surplus on the market, regardless of price or other consideration. To the minds of those charged with the responsibility of the disposal of war surplus, a plan such as this with industry at that particular time carrying its peak load, would have been little short of criminal, a knife thrust in the heart of business. The war department fully recognized its responsibility for the public welfare and took into account every angle of possible ill effect of such a plan on established trade and industry. Because of its probable disastrous effect, this plan was eliminated.

Store Plan Impracticable

Still another plan that suggested itself as being particularly adaptable for a wide range of materials was the es-

From an address delivered at the invitation of various chambers of commerce and business organizations. Maj. James L. Frink is chief of the sales promotion section of the war department, Washington.

tablishment of a number of government-owned stores. This plan was tried out in a limited way, but found impracticable. The overhead of these stores soon reached a point which made their further operation unprofitable. The government could not meet private competition. It was impossible to keep complete lines of all items in stock without placing fill-in orders with manufacturers. This would have been outside of the authority of law, and contrary to removing the government as a competitor in business, which was the final object of liquidation, would eventually have resulted in involving the government still more deeply. These stores were useful, however, in introducing to the public a variety of articles for which previously there had been little general use and practically no demand. In other words, they created a market in which they themselves could not compete. The government had to give way to private business, which could and does keep lines well balanced with fill-in-orders, thus helping the manufacturer and the jobber.

Out of the discussion of the various plans suggested, there developed a very definite policy, safe, sane, reasonable and in keeping with the interest of business men, as well as the interest of individual citizens and taxpayers. That policy was the gradual liquidation of surplus, the rapidity of such liquidation being governed by the ability of the markets to absorb the various commodities without undue interference with established industry, while at the same time safeguarding the public interest in every possible way.

No Competition

In the application of this set policy of liquidation, the establishment of the office of the director of sales was one of the first essentials. The various supply services of the army such as the quartermaster department, the ordnance department, air service, engineer corps, signal corps and others, each had in their possession and controlled a large amount of property, much of which was to become surplus. Had these services been permitted to act independently of each other in the disposal of this surplus, it would have been impossible to have prevented one competing with another. There would have been no such thing as effective supervision and nothing at all of that co-ordination so necessary to success. Each of the services I have just mentioned designated an official to supervise and control the disposal of all surplus property held by that service. The activities of these officials, usually known as surplus property officers, were in turn co-ordinated and controlled through established channels from the office of the director of sales. The magnitude of operation is reflected by the sales figures of the two largest services; the quartermaster corps, which to Dec. 15 last had disposed of property which cost the government approximately $1,500,000,000 and the ordnance department, following with approximately $675,000,000.

Supplies Greatly Reduced

During the first year of liquidation, sales were made by negotiation, sealed bid, fixed price and auction. Each succeeding year has increased the difficulties of selling, and caused a revision of our methods. At the present time no sales are made by negotiation unless the property concerned has first been offered to the public at large by sealed bid or auction and failed to bring a satisfactory offer. Besides, experience has proven that, as a rule, on commodities such as are now being offered, higher prices are obtained by auction than by any other method.

The progress of liquidation has in the main been extremely satisfactory and gratifying to those connected with the business organization of the government. Sales have kept abreast the declarations of new surplus reported from the various supply departments and from now on should exceed these declarations by a good wide margin. Since the establishment of the office of the director of sales property originally valued at over $2,000,000,000 has been sold and the visible supply reduced to about $200,000,000. Estimates of future surplus to be reported will swell this total to approximately $400,000,000 cost value, which still remains to be sold.

An interesting problem that confronted the ordnance department was the disposition of an enormous amount of ammunition for artillery and for small arms. There was no domestic market for ammunition as such, government-owned facilities were not equipped to break down this ammunition in large quantities, nor did the government desire to assume the risk involved. I do not believe more consideration has been given to any single proposition that has come before the director of sales, nor do I believe that a more complete or searching investigation could have been made to secure the best interests of the government before and after making the contract that was entered into. This contract was made with a large salvage corporation, which undertook to take over from the ordnance stocks "as is" "where is" all ammunition, unload it, break it down into commercial products, such as scrap metals and chemicals and place these products on the market. The contract provided for the government to receive 40 per cent of the gross proceeds of sale, the salvage company 60 per cent, while the control of the price was retained by the ordnance salvage board. Thus was the government enabled to dispose of its huge holdings of ammunitions without the outlay of a single cent for additional overhead expense, without incurring any liabilities whatever, and by its control of price undue pressure on the regular markets was prevented. Furthermore, the particular interests of industry were additionally safeguarded by turning this ammunition over to the salvage company at times and in such quantities as not to unduly disturb the industrial equilibrium.

Picture if you will, more than 100,000 items, each with a market problem of its own. The quantities in which some of these items were held demanded the utmost care and consideration be given to their disposal. Let us take one item, wool, the disposal of which is typical and illustrates clearly how the government's methods have worked for the good of all.

It should be recalled that the government through the quartermaster corps of the army took over the entire wool clip of 1918, together with all wool in the hands of dealers. The total amount taken over by the government was slightly in excess of 674,000,000 pounds, at a cost of approximately $478,000,000, or an average price of 71 and a fraction cents per pound.

The liquidation of the wool stocks of the quartermaster corps, began under the direction of the present quartermaster general who at that time was zone supply officer at the army supply base, Boston. In this work he was ably assisted by Mr. Albert W. Elliott, chief of the wool top and yarn branch of the Boston depot. A large measure of credit is likewise due Col. Ralfe, quartermaster corps, whose able supervision of the work at the Washington end made possible its prompt consummation.

Wool Recovered 86 Per Cent

Prior to the armistice the government had allocated for use about 210,000,000 pounds, leaving on hand available for sale as surplus about 465,000,000 pounds. The total recovery on the entire purchase was remarkable, the average percentage being in excess of 86 per cent of the cost,

and this squarely in the face of approximately a year and a half of most serious business depression in 1920 and 1921.

The liquidation of this enormous stock of wool presented innumerable difficulties and the decision to dispose of it through a series of auction sales to properly safeguard the interests of the government and of industry met with considerable opposition from several sources. Notwithstanding this opposition, the government persevered in its plan. The complete disposal of this government-owned wool was consummated by auctions divided into 49 series, comprising 118 separate auction sales and nine sealed bid sales.

Wool Sales Suspend

Early in the summer of 1920, after the long expected readjustment in wool values had become apparent, all wool sales were temporarily suspended to permit conditions to settle. The readjustment process in wool and woolens was extremely severe, and every reasonable measure was taken to protect the interests of the wool industry of the country, consistent with the best interests of the people. Not a pound of wool was marketed from then until September of the following year that would come into direct opposition with domestic grown wools. The department fully realized the condition of the wool producers of the West, who were in financial distress, owing to the wool break of the summer of 1920, and the quartermaster general offered only low grade wools of South American growth. This was good business for two reasons; first, that it afforded a great measure of relief to our own wool industry; second, the only wool market that existed, worthy of the name, was for low grades, suitable in the carpet trade.

Early in the year 1921, the present administration came into power and final authority on wool methods was invested in the assistant secretary of war, Mr. Wainwright. The effects of the emergency tariff in the wool industry became apparent in September of that year and wool prices advanced slightly. The government stock of wool of low grades which had been set apart as suitable for carpets, by that time had become depleted, and medium to low grades began to be included in the offering. From then on, all wools were offered successfully. The wool auction room in Ford Hall, Boston, was crowded at every sale. There was keen competition for all qualities, with constantly advancing prices. The final sale was held in March, 1922, and the government went out of the wool business.

Another instance of the department's desire to co-operate with industry in every possible way consistent with the best interests of the government, was in the sale of some 56,000,000 pounds of brass cartridge cases. This sale permitted the absorption of this large amount of metal without disrupting or unsettling market conditions. The government's plans for the sale were announced, and raised widespread interest. Bids were received from a wide range of industrial concerns. The price paid to the government was based on the market value during the month in which the material was moved, as reported by three recognized business papers, less a deduction of 2 cents per pound for refining. The terms of sale on which the final award was made provided for the placing of this material on the market over the period of one year at prices which varied and were contingent upon market conditions, thus preventing the possibility of the material being used for the purpose of unsettling or unduly influencing the market and eliminating any possible unwarranted speculation.

Small Buyers Considered

The war department sales campaign has been unique in many respects. The methods of sale adopted have provided for the disposal of stocks at points at which they are located, in such a way as to permit the small buyer, as well as the large buyer, to participate. Every possible precaution has been taken to prevent the creation of a monopoly which might enable a purchaser to charge exorbitant prices and realize undue profits. The methods adopted have protected the manufacturing industries of the country against ill effect not absolutely unavoidable in the liquidation of such large stocks and at the same time they have secured for the users, the public, the advantage of low prices, at which they were able to buy commodities readily usable.

Few sales have been made on any other than a strictly cash basis, except that in the auction sales bankers' acceptances, payable in 90 days, issued by the banks of the federal reserve system, have generally been authorized for acceptance up to 80 per cent of the total purchase price. Prices received have ranged from as low as ½ of 1 per cent of the original cost to as high as 116 per cent. Much of the material sold, especially during the past year, has been of special design, with little, if any commercial use.

Notwithstanding the loss on this class of materials the result to Dec. 15 last was an average return of 41 per cent of the original wartime cost. This stands as an achievement of which the government may well be proud. Bought at the peak of prices, sold over the scaling down period in their markets, a large portion of special material of little or no value to industry, some reclaimed material, not a nickel's loss written off on inventories, yet a return of 41 per cent of the original cost.

More Offers Received

Not a single traveling salesman has been employed, but instead, with the exception of the office of the director of sales, dependenc has been placed in government agencies already existing, supported by a well-defined advertising campaign in the newspapers and business papers of the country. This campaign has been national in its scope, embracing every field of industry and has provided the widest possible publicity. Once every month the war department program of sales is published throughout the country. Supplementing this, every important sale is extensively advertised so that industry and the public may be fully informed as to when and where sales are being held, what is being sold, and how to buy it. The advertising appeal has been directed always toward established business, and not to the speculator. At every point the greatest difficulties have had to be overcome in the way of hostile propaganda, caused by mistaken ideas of the effects of our policies or a lack of understanding of what is best for the public good.

I would like you to realize just what this campaign has done and is doing right now for us. In order that you may get some impression of its actual value, I am going to tell you of a certain incident:

In the latter part of October, 1919, we offered for sale, by sealed bids, about 100 lots of various textiles, which were to be sold as a whole, or by each lot, or in a minimum of 2000 yards of each lot. Bulletins containing descriptions of the merchandise, where stored, and other information, were sent out to a list of what was thought to be representative prospective buyers located in various sections of the country.

News articles, not paid advertising, were run in a number of business papers and newspapers, mentioning the

date of sale, some of the goods to be sold, and terms. We received the grand total of eight bids, none of them for any considerable quantity.

About two weeks later when our advertising policy had been approved, practically this same list of goods, for none of the eight bids received were accepted, was made the medium of our first attempt to make paid advertising an aid in selling our surplus. I do not recall just exactly how many bids were received, but it took our abstract division two whole days to make an abstract of the bids which we did receive for consideration.

Actual sales made amounted to approximately $780,000 and bids were rejected amounting to approximately $260,000. In other words, the bids received on the same list of goods which two weeks before had been advertised with only eight offers materializing, produced a total offering of more than $1,000,000, on merchandise which had been appraised at approximately $800,000. More important than this possibly is the fact that our surplus is being sold in practically every state in the union as against the very limited number of buyers prior to the introduction of advertising.

This has resulted, I believe, in our obtaining a greater percentage of returns to the government, of telling everyone everywhere what we have to sell, when, where and how it will be sold, and removing any cause for complaint by reason of the prospective buyers not knowing of these sales, which condition may easily have prevailed under previous methods.

I particularly want to bring this thought to your direct attention, for the reason that I believe advertising to be one of the greatest forces in modern business, whether it be private or governmental, and I am morally certain that it has proven so in our own particular work.

Late in 1920 the assistant secretary of war was specifically charged with the sale or other disposition of surplus property, thus placing the office of the director of sales under his supervision. When Mr. Wainwright became assistant secretary, with the advent of the present administration, steps were taken for doubled activities in the disposal of surplus property, that business might proceed unhampered by this bugaboo of great stocks that might be dumped on the market. Mr. Wainwright has recently selected as his assistant, Colonel J. P. McAdams, general staff, formerly deputy chief of staff, service of supplies of the A. E. F., whose vast fund of knowledge has proven of untold value in the solution of the many problems that continually arise.

The staff of the director of sales, Major Glen E. Edgerton, corps of engineers, is composed entirely of officers of the army. His chief assistant is Major C. D. Hartman, quartermaster corps. Both Major Edgerton and Major Hartman are officers of wide experience in supply matters, thoroughly schooled in business and economics. The present successful progress of liquidation is due to their careful administration, foresight and devotion to the public service.

Business Methods Used

In their determination to clean up matters quickly these officials have been aided greatly by the establishment of the bureau of the budget under General Dawes, and now so ably carried on by General Lord, and by the introduction of the principle of co-ordination and up-to-date methods of administration throughout the government's business organization, which permitted the huge supply of war surplus then remaining to become a still greater national asset. The establishment of the office of the chief co-ordinator, general supply, to operate directly under the bureau of the budget, and the appointment of Colonel Smither to that office was a further step forward in saving this huge war surplus for the common use of the people. Under the chief co-ordinator there was set up several boards, two of which were very much concerned with what was done with the surplus, the federal liquidation board and the federal purchasing board.

The chief co-ordinator through the medium of these two boards just mentioned, kept close check on the requisitions for purchase submitted by the various executive departments and on the material to be sold under the supervision of the director of sales. Material requisitioned for purchase and which was found in the war department's surplus stocks was transferred to the department in need, either with or without funds, as provided by law and the purchase requisition canceled. By this procedure alone, millions of dollars have been saved to the taxpayer.

Great War Surplus

The engineering department of the army required certain dredges in their operations which would have cost $349,500. Surplus boats in the hands of the quartermaster corps, which, if sold, would realize but a small fraction of their value, were transferred to meet this need. The money was saved. Again, the lighthouse service of the department of commerce, had an appropriation of $1,500,000 for the purchase of lighthouse tenders. The army transferred to this service mine planters, which were readily convertible, but which had little or no market value, and had they not been so transferred, would of necessity have been left rotting at the docks under continued expense to the governmnt. A million and a half dollars were saved.

Likewise large rentals have been saved by the prompt disposition of government surplus occupying leased storage. Some time ago the ordinance department declared surplus some 81,000 tons of sodium nitrate, storage on which was costing the government annually over $88,000. This nitrate was placed on the market at a time when it could be readily and easily absorbed, the government realizing on the sale $2,750,000 which sum was turned into the treasury, and this rental of more than $88,000 and other attendant expenses saved.

That you may the more fully realize what the proper use of this great war surplus has meant to the government in balancing its budget, and particularly to you who ultimately bear the burden of expense, let us refer to the figures for the last fiscal year, ending June 30, 1922. Transfers of the character just mentioned were valued at $147,297,000. The estimated savings on these transfers amounted to $44,546,335. In addition to this, there was turned into the treasury of the United States from the sale of surplus supplies, the sum of almost $90,000,000. This sum plus the savings by transfer more than equalled the pay of the army for the same period.

The total transfers authorized from the war department to other departments, up to Jan. 1 of this year, were originally valued at nearly $318,000,000. Including these transfers the total amount reclaimed to the government during the period of liquidation to date is well over $1,250,000,000. And remember I have spoken of but one department. Our navy, too, has been on the job. Its problem, while not so large, has been handled in magnificent style.

Your government as a competitor in business is not wanted nor does it want to remain a competitor. As a representative of the common interests we both have in this matter, I think I may express the mutual satisfaction that we shall both experience when the auctioneer raises his hammer for the last time at the final sale, and Uncle Sam as a competitor takes the count, GOING, GOING, GONE!

Fig. 1—The old method of hand assembling detachable chain still is used extensively and for special shapes probably never will be replaced

Casts Malleable Chain Links

Chain Assembled from Individual Links Molded on a Power Squeeze Machine from a Metal Gated Pattern—Annealed in Pots Packed with Mill Scale—High Strength Metal Required

BY HERBERT R. SIMONDS

IN DESIGNING chain of any type, one of the chief considerations is the method of connecting the individual links. Wherever the links are joined in the actual process of manufacture, as is the case in cast steel chain and forged chain, the problem is removed from that of manufacturing an individual link and becomes one wherein the entire length of chain must be considered. Individual links for cast anchor chain sometimes are made up separately and spaced a link apart in a row in a long mold, the intermediate links then being cast through these first links, but here half of the links must be considered as a part of the completed chain and not as individual pieces. Malleable detachable chain has been designed to overcome the consideration of a whole length of chain in the manufacture of each individual link. In the manufacture of detachable chain such as that shown in Fig. 1 each link is made separately just as a pipe fitting or a sprocket wheel is made. The individual molder may never see the completed chain. His job is to produce accurate links, and when this is done, his responsibility ends.

The design of detachable chain is not as simple as it at first appears. The links must fit together easily so as to reduce the cost of assembling, and yet they must not come apart so easily that the chain would be separated in handling. The link must be simple so as to reduce cost of making molds and pouring castings. It is the usual practice to cast from 8 to 72 links in a single mold depending upon the size of the chain. For chain from 1 to 3-inch pitch, from 8 to 16 links usually are made up on a single gate. Such an arrangement is shown in Figs. 3 and 4. The links are each connected with the central heavy gate at two points, the design of feeders and risers has been worked out carefully to give a quick and simultaneous flow of metal to all parts of the mold. In the design of this chain each link, in effect, has a shaft at one end called the end bar, and a cutaway journal at the other end called the throat. A slight notch, A, Fig. 3, is left at one end of the end bar of each link and it is this that makes it possible for the throat of one link to be slipped over the end bar of the next, thereby developing the chain.

Illustrating this feature of design Fig. 1 shows the operator assembling 2-inch pitch chain by hand. This particular chain is molded on a power squeeze machines such as that shown in Fig. 4. Here it may be seen that the pattern consists of a permanent gate carried in a frame. One side of this gate forms the drag and the

FIG. 2—CARE IN PACKING THE LINKS IN THE ANNEALING POTS IS NECESSARY TO GUARD AGAINST WARPING

other the cope. The cores forming the throat of each link consists of short cylinders which are placed in the drag shown on the molding machine. The method of making the mold is similar to that for any careful gate work except that the tolerance is unusually low because of the necessity of a close fit between the links. The work, however, even though it must be accurate, is performed rapidly by experienced molders. One molder with the equipment shown in Fig. 4 will turn out 1500 links of 3-inch pitch chain in a day of 8-hours. The castings as they appear when the shaken from the molds are shown in Fig. 3. These are broken off from the gate, are inspected, ground and then annealed.

Annealing Important Operation

Chain is more easily subjected to tensile tests than most other forms of castings. Two lengths of chain of a similar size may be compared easily by stretching to destruction on a simple form of testing machine. It is perhaps for this reason, as much as for the actual service requirements, that chain manufacturers are anxious to secure as high a tensile strength as possible. Whatever the reason, the strength of the metal entering into the construction of cast malleable chain has been the subject of more than usual attention. To illustrate the development along this line, some years ago a 5-foot length of about 1-inch pitch chain suspended at one end would break under a 1000-pound weight carefully applied at the lower end. Today a good grade of 1-inch pitch chain of similar design will easily carry a weight of 1800 pounds.

To obtain this strength in small sections of malleable iron, it has been necessary to study closely every step in the manufacture. The analysis of

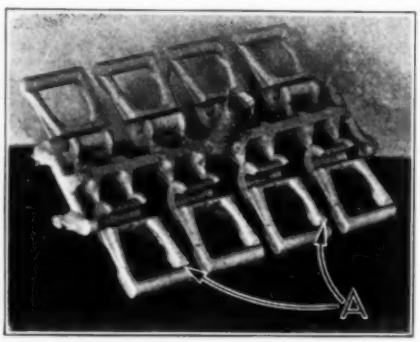


FIG. 3—CHAIN LINK CASTING AFTER BEING SHAKEN FROM THE MOLD

the metal as it is tapped from the furnace is an important consideration, but equally important is the annealing process. In annealing three principal points must be considered: Securing of the proper softness in the iron; preventing of warping; and limiting the formation of scale. The desired iron softness is obtained by a study of the white iron or hard iron analysis and the application of heat of the correct temperature for precisely the right length of time.

The problem of warping in the case of chain links is an important consideration because even a slight distortion will prevent easy assembling and may cause excessive wear at one side or the other of the end bar when the chain is in use. For this reason the links are packed carefully in annealing pots as shown in Fig. 2.

Packed With Mill Scale

The space between the links is filled with mill scale and the whole pot is jarred after being filled so as to obtain a more compact and even distribution of pressure around the individual pieces. In the plant of an eastern manufacturer, where the illustrations in this article were secured, these pots filled with link castings are placed in tiers of five and are then transferred by means of a lift truck to a large annealing oven where they are subjected to a gradually rising temperature over a period of about 36 hours. At the end of this time the temperature, which has reached 1500 degrees Fahr. is maintained on an even level for 72 hours, after which the furnace is allowed to cool down

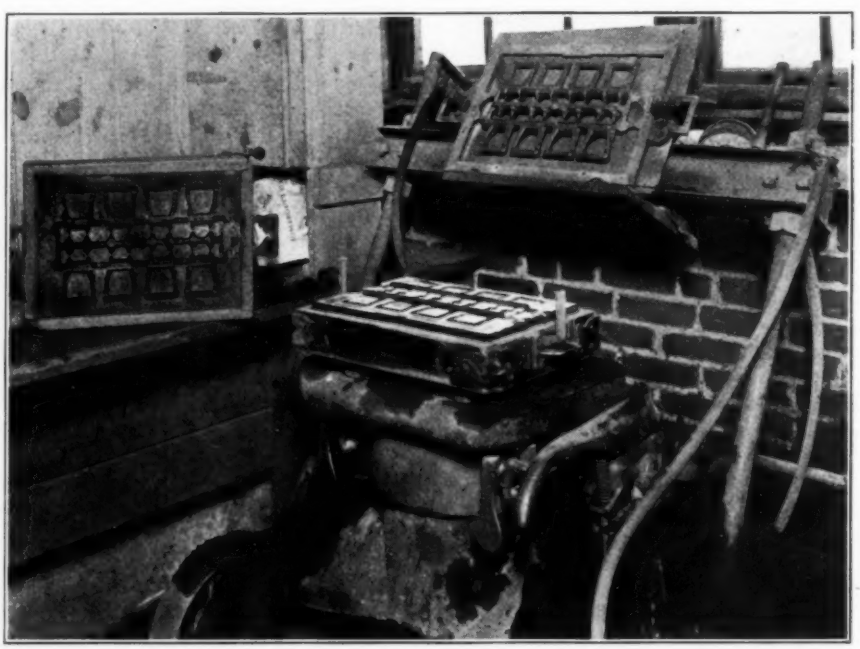


FIG. 4—MOLDING MACHINES ARE USED FOR MAKING UP THE MOLDS. METAL GATED PATTERNS ARE USED AS SHOWN

gradually to about 200 degrees Fahr., when the annealing pots are taken out and dumped onto grids which catch the castings, but allow the packing material to fall through. The mill scale is used first to perform the mechanical duty of preventing warping and second the chemical duty of preventing the formation of scale.

From the grids where they are dumped after annealing, the castings are transported to an inspection room. Here they are given a second inspection so that the links which leave this department for the assembly room are uniform and practically flawless. Making chain out of castings of one form or another is one of the oldest methods known. Malleable iron chain is extensively used, first, because it lends itself so readily to special design and, second, because the first cost is low; being about one-fifth of that of steel chain for the same purpose. The lumber industry is probably the largest user of malleable detachable chain and in most lumber plants chain is used for moving the material in all operations from the initial hoisting of the log through to the finished lumber. In some cases transfer tables in lumber mills require a chain a mile or more in length, and the expense of this in steel chain would be considerably out of proportion to the life of the average lumber plant. The mining industry also is an exceptionally large user of malleable chain made in the foregoing manner.

Ceramic Society Discusses Refractories

REGISTRATION of nearly 600 members of the American Ceramic society, which held its twenty-fifth anniversary convention in Pittsburgh, Feb. 12 to 16, far surpassed the attendance of any other meeting of the body since its organization. Frank H. Riddle, Champion Porcelain Co., Detroit, presided at the general sessions. During the transaction of brief business an amendment to the by-laws of the society admitting college students to memberships at a reduced fee was adopted.

At the afternoon session Edward Orton, Jr., Orton Pyrometric Cone, Detroit, founder of the Ceramic society and of the first school of ceramics in the world, at Ohio State university, Columbus, O., and now practically retired from the active pottery and ceramic work, was tendered a boisterous ovation when he appeared. His address entitled "The Value of Ceramic Engineering Education," was directed to all classes of engineers. He urged those of the profession to take a greater part in public affairs than now is being done by engineers in general and cited Herbert Hoover and Gifford Pinchot as examples of men with engineering education who have taken notable positions in public life.

Dean Cooley, University of Michigan, Ann Arbor, Mich., spoke upon the work that has been accomplished by the Federated American Engineering societies and cited this organization as a typical example of the valuable work engineers can do for the good of the public. Dr. Walter Rosenhain, in charge of the metallurgical department of the National physical laboratory, Teddington, England, spoke upon the development of both industries in England. Ways in which the bureau of mines can cooperate with and be of material assistance to the ceramic industries was discussed by Dr. H. Foster Bain, director, United States bureau of mines.

The first day of the silver jubilee convention closed with a banquet in the evening attended by over 400 members of the society. Officers for the coming year were installed and include A. F. Greaves-Walker, American Refractories Co., Pittsburgh, president; R. D. Landrum, Cleveland, vice president; Ross C. Purdy, Ohio State university, Columbus, O., secretary; R. K. Hursh, University of Illinois, Urbana, Ill., treasurer. Trustees elected were R. M. Howe, Mellon institute, Pittsburgh; B. E. Salisbury, Syracuse, N. Y.; F. H. Riddle, Champion Porcelain Co., Detroit; and R. R. Danielson, Washington.

REFRACTORIES EXHIBITORS AT CERAMIC SHOW

Lavino Refractories Co., Philadelphia.
American Refractories Co., Joliet, Ill.
Mitchell Clay Mfg. Co., St. Louis, Mo.
The Carborundum Co., Keasbey, N. J.
Charles Engelhard, Inc., New York.
Crescent Refractories Co., Curwensville, Pa.
Precision Grinding Wheel Co., Philadelphia.
Norton Co., Worcester, Mass.

Technical sessions were held simultaneously the second and third days of the convention at the Fort Pitt hotel under the auspices of the industrial division. The sessions were divided into seven sections, one of which was devoted to refractories.

Thursday and Friday were given over to plant visitations. The visiting members were divided into groups. One party made visits at the plants of the Standard Sanitary Mfg. Co., the Pittsburgh Clay Co., the United States Glass Co., the Willets Co., the Woods-Lloyd Co., and at the Mellon institute and Carnegie museum and library. Trip No. 4 in charge of D. M. Buck, metallurgist, the American Sheet & Tin Plate Co., included an inspection tour of the Clairton by-product coke plant of the Carnegie Steel Co., Clairton, Pa., and the steel and zinc works of the American Steel & Wire Co., Donora, Pa.

On Friday one section went to McKeesport for a tour of the National works of the National Tube Co., and visited the Harbison-Walker Refractories Co. at Hays and the by-product coke oven plant of the Jones & Laughlin Steel Co. at Hazelwood, Pa., also to East Pittsburgh, Universal and Derry where the plants of the Westinghouse Electric & Mfg. Co., the Universal Portland Cement Co and the Westinghouse High Voltage Insulator Co. were visited.

An exhibition of ceramics was held at the Fort Pitt hotel in conjunction with the convention of the society. Companies having various refractory products on display are indicated in the accompanying table.

Sinters Magnesite for Metallurgical Use

The Carborundum Co., Niagara Falls, N. Y., announces that it is now in a position to supply electrically sintered magnesite to the metallurgical industry. The product made by this company is manufactured from California magnesite which is fused in electric furnaces. It contains about 95 per cent magnesium oxide and less than 1 per cent iron oxide. It has a melting point of about 2600 degrees Cent., and can be supplied in the form of large lumps, grain or powder to suit the conditions of the user. It is shrunk and is said to show no contraction when subjected to conditions encountered in industrial installations.

The firm Stanley G. Flagg & Co., Inc., Philadelphia, has succeeded the Stanley G. Flagg & Co. by purchasing the latter's assets and assuming its liabilities. No change will be made in management or ownership from that of the previous firm.

Construction of Coreboxes--II

Large Coreboxes Are Framed To Prevent Warping and Distortion—Where a Core Is Symmetrical a Half Corebox Usually Is All That Is Required To Form a Whole Core

BY JOSEPH HORNER

AN EXAMPLE of a half corebox in which the half cores are symmetrical and designed for the standard of a vertical engine is shown in Fig. 16. The distance *A* corresponds to the thickness of the print at the bottom of the casting. At other points the core is supported on chaplets. The box frame with ends rebated into the sides, is carried on a bottom board to which some fittings are attached. *C C* represents portions of the lugs for the holding-down bolts. The cylinder is cast integral with the standard and the print at *D* receives the cylinder core. The blocking within the frame follows the contour of the casting with an average allowance of one inch for thickness of metal. The core cuts through on two sides to the outline shown in the plan view.

Fig. 17 illustrates a corebox for a gas valve casting. The frame has one semicircular end, built up with sector pieces. It is doweled on a bottom board made of open jointed strips and battened. The board is necessary to locate accurately one of the beveled facing pieces for the valve or plug. A similar facing piece on the top is located and secured with two battens doweled on the top edges of the frame and indicated in the illustration by dotted lines. Round prints on the facings provide a resting place for the branch cores. Guide strips for the valve are fastened to the sides of the corebox frame. In some cases a half corebox is just as satisfactory from the foundry viewpoint as a whole one. Of course this only applies when the half cores are symmetrical. An illustration of this kind is shown in Fig. 18, a half corebox for a gas valve. It differs from that shown in Fig. 17 in that the branch cores are made integral with the body core. A corresponding difference exists in the method adopted for making the mold. In Fig. 17 the branches are molded up and down, being left loose on the pattern for that

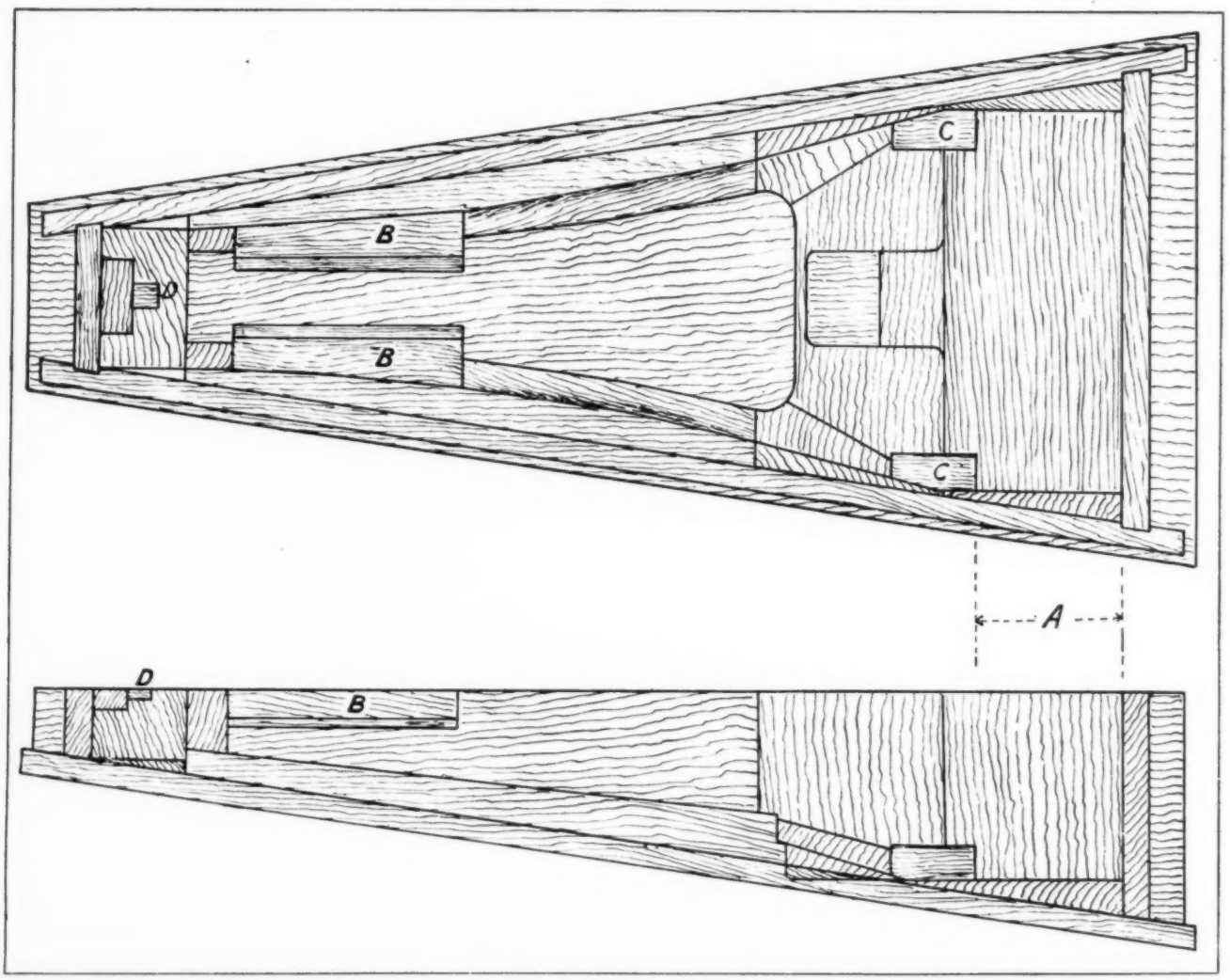
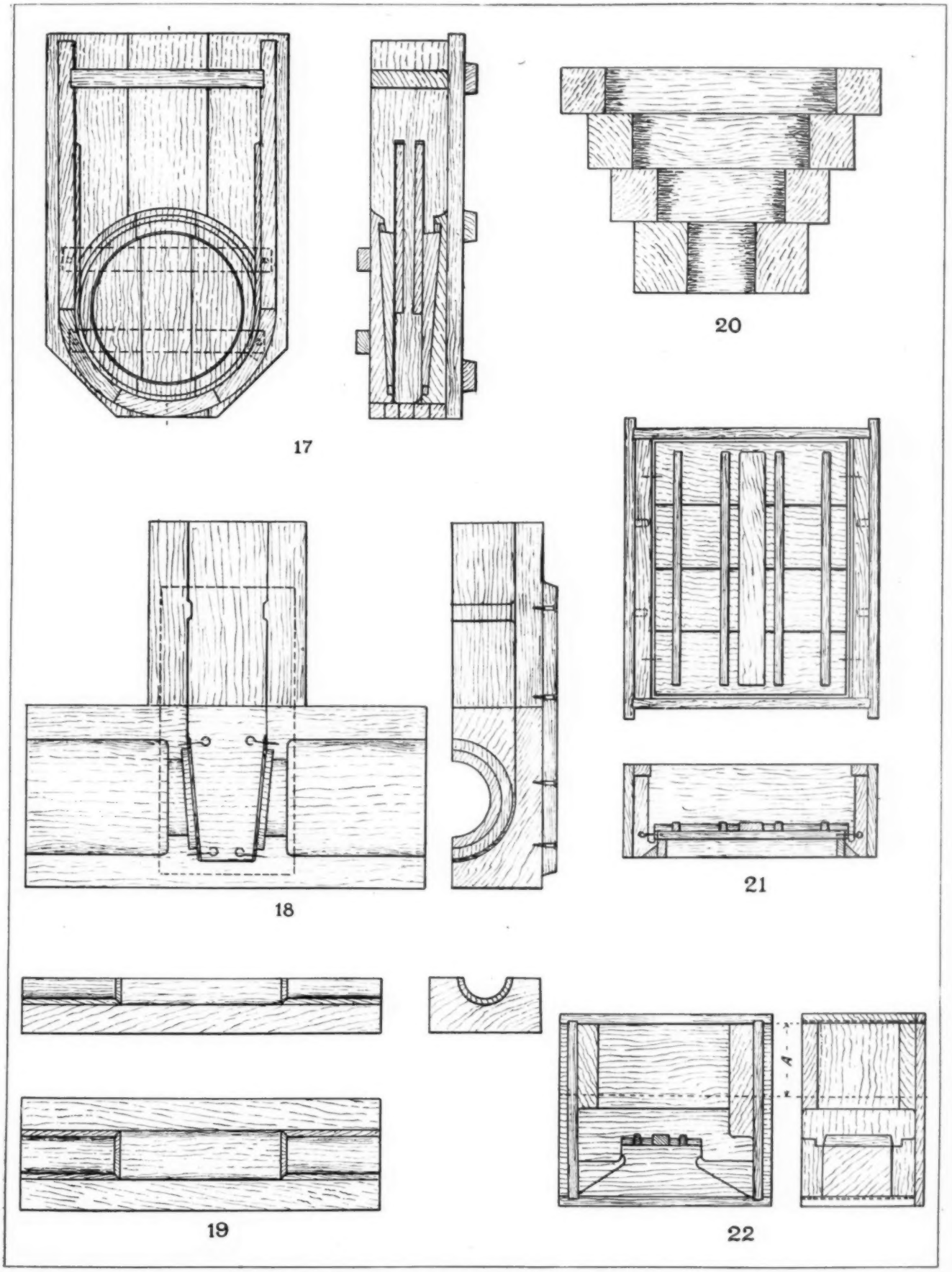


FIG. 16—WHERE THE CORES ARE SYMMETRICAL A HALF COREBOX USUALLY IS EMPLOYED. THE HALF CORES ARE PASTED TOGETHER AFTER THEY ARE DRIED



FIGS. 17 AND 18 ILLUSTRATE TWO METHODS FOR MAKING A GAS VALVE CORE. FIG. 19 A CHAMBER CORE. FIG. 20 IS A COREBOX FOR A CONE PULLEY AND FIGS. 21 AND 22 ARE COREBOXES FOR STEAM CHESTS

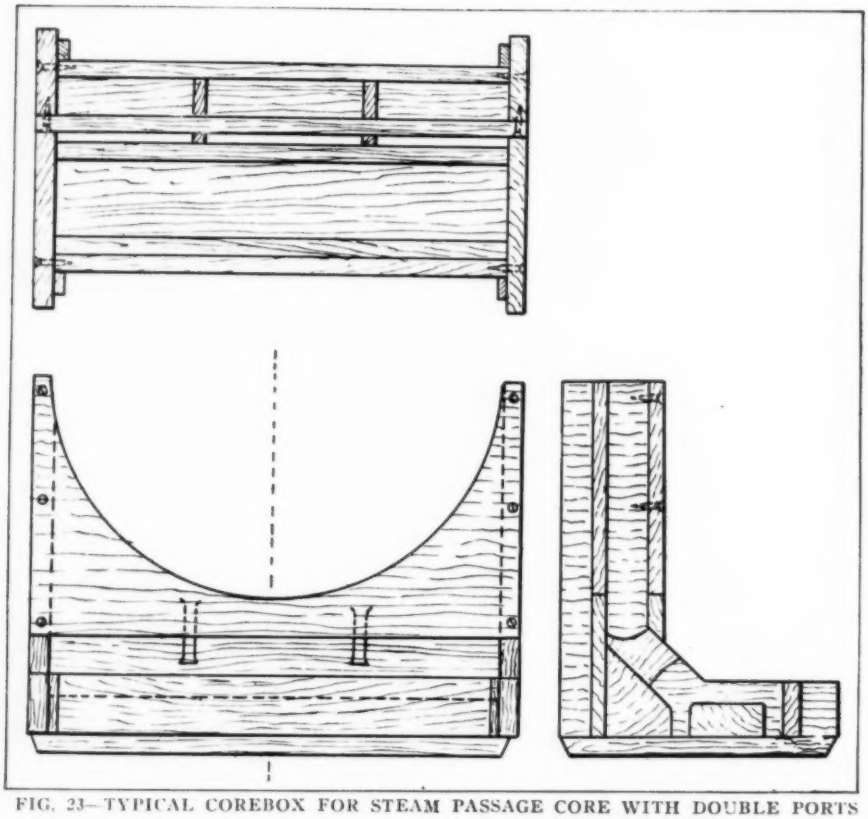


FIG. 23—TYPICAL COREBOX FOR STEAM PASSAGE CORE WITH DOUBLE PORTS

purpose. In Fig. 18 they are shown attached firmly to the body of the pattern which is designed to be molded on its side. Either method is practical, but the second is more simple and convenient than the first. In the corebox shown in Fig. 18 the two halves of the box are secured to each other by a broad batten. The semicircular shapes are cut in solid stuff. In large boxes, blocking up would be better. Two facings to receive the brass seatings for the valve are attached by pins and removed from the core after the box has been withdrawn.

Half Coreboxes

Fig. 19 is an illustration of a half box which shows how cylindrical interiors of different diameters are shaped, instead of cutting them out of solid material. The box first is finished to the larger size and then the smaller ends are turned in the lathe, cut in two and inserted at the necessary points. This method is adopted where standard cores of one diameter are required presenting different lengths of *chamber*. The annular pieces are fastened with screws and may be shifted to different locations as required. In all cases of this kind a half corebox suffices, since the half cores are symmetrical and may be pasted together.

A half corebox for a cone pulley is shown in Fig. 20. It is divided to provide a different width on each step. This method is not recommended for standardized work, because the lumber will warp and shrink and produce elliptical cores. In the event that this method is adopted the lumber must be perfectly seasoned and the corebox well varnished both outside and inside. A corebox built up of sector pieces is preferable to the one shown, but is more expensive. Fig. 22 shows a corebox for the steam chest of a medium size engine cylinder. It carries the prints for the steam passage cores. The core is entirely supported by one print and therefore it is made quite large as shown at *A* where the print is attached to the face of the steam chest. The dimensions of the print, that is the length and thickness, correspond to the distances between the blocking pieces inserted in the box. The frame and some of the blocking rests on a bottom board. The outline of the block to which the passage cores are attached corresponds to the metal thickness around these cores.

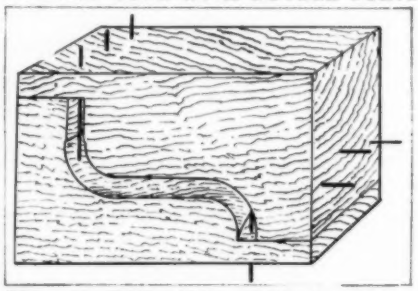


FIG. 24—TWO-PART COREBOX FOR SMALL PORT CORE

Large Steam Chest

A corebox somewhat similar, but much larger, is shown in Fig. 21. It is for the steam chest of a double ported low pressure cylinder. It carries the prints for the steam passage cores, each about 3 feet long. The box is framed at the corners and encloses a bottom board, set up at a definite height to form the face on which the slide valve operates. The prints are attached directly to this face. On large boxes of this character it will be noted that the bottom board is made with open joints. The walls of the steam chest are stiffened by the horizontal and vertical ribs shown.

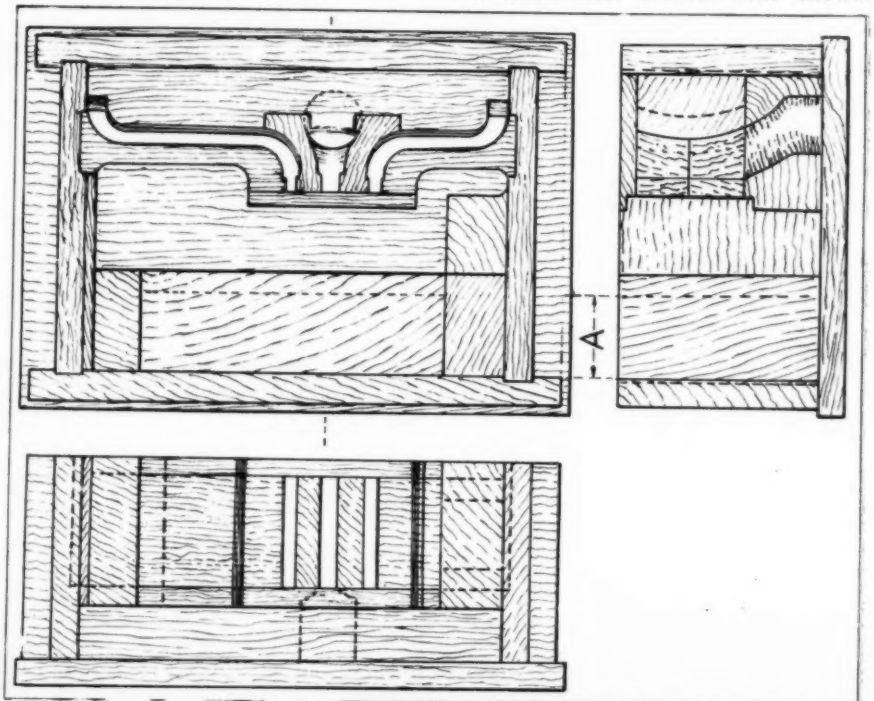
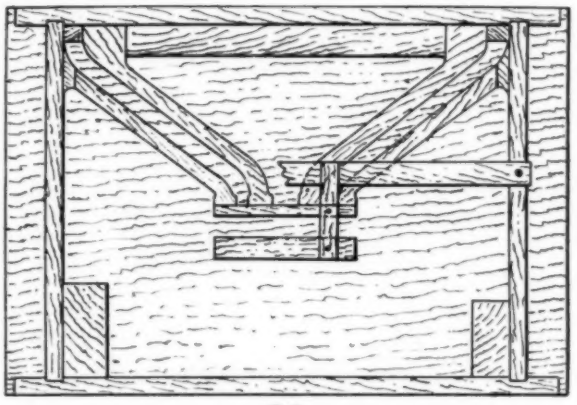


FIG. 25—THE STEAM PASSAGE CORES AND ALMOST THE ENTIRE EXHAUST CORE ARE INCLUDED IN THE STEAM CHEST COREBOX



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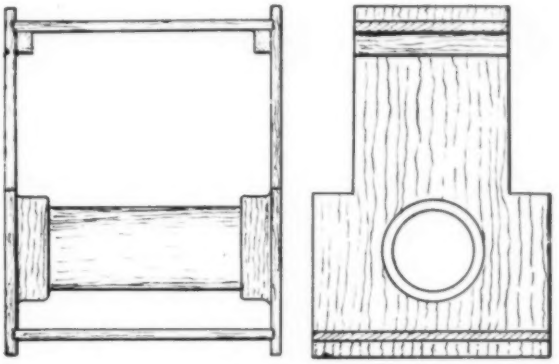

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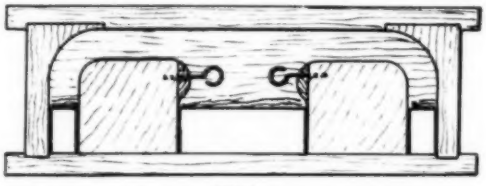

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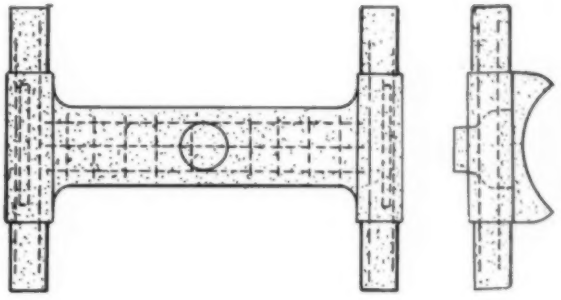

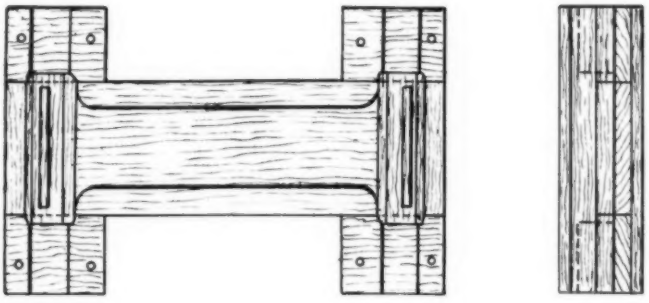

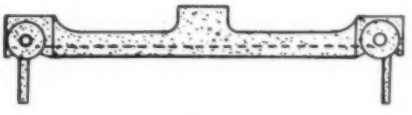

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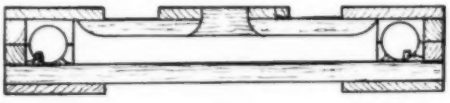

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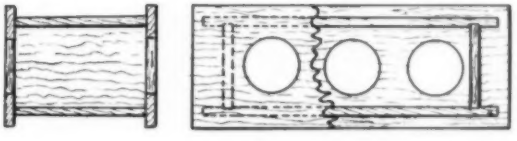

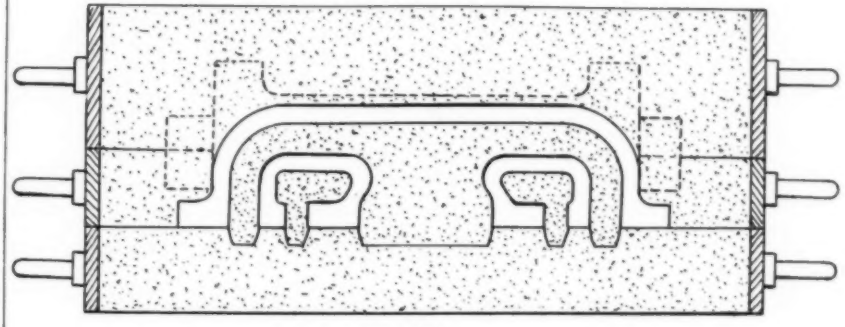

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FIG. 26—ANOTHER TYPE OF CYLINDER COREBOX IN WHICH THE STEAM PASSAGES AND EXHAUST CORE ARE FORMED INTEGRAL WITH THE STEAM CHEST CORE. FIG. 27—COREBOX FOR DOUBLE PORTED SLIDE VALVE. FIG. 28—CORLISS CYLINDER STEAM PASSAGE COREBOX. FIG. 29—MOLD SECTION. FIGS. 30 AND 32—COREBOXES FOR CONDENSER CORES. FIG. 31—WIRE GRID AND VENTS

Fig. 23 shows the corebox for the steam passage core with the double ports. The curved edge that fits the barrel core is formed by a strike guided by the box edges. The main passage is rammed between the two vertical walls. Brackets are provided in the core to tie the walls together. Without the brackets the walls would bend and become distorted due to the hard core in between them. The port openings correspond to the prints shown in Fig. 21.

A common port corebox is shown in perspective in Fig. 24. This view also shows the method of venting the core by inserting wires at certain points before placing any sand in the box. The rods are withdrawn before the corebox is removed from the finished core. Usually the curved connections at the ends are filled with wax and covered with core sand. Several individual wires or a light grid is used to reinforce the core and also serve as a medium for anchoring the core in the core print. The box shown is made in two parts cut from solid material, a form of construction only suitable for small cores. Large and even medium size coreboxes are framed together to avoid the effects of shrinkage and warping.

All Cores In One Box

The steam passage cores and almost the entire exhaust core, are included in the steam chest corebox shown in Fig. 25. This method of construction does not apply to all cases but the example shown presents no special difficulty. Wherever practicable, this method eliminates the bother and risk incident to inserting and anchoring the passage cores in the barrel core and also taking care of the vents. The entire core is carried in the impression of a print provided on the steam chest with an ample thickness as indicated at *A*. By referring to the sectional view taken across the box it will be seen that the pieces which form the passages are divided along the center so that the corebox may be removed from the core after it is placed on the plate. Fig. 26 shows a corebox of a different shape and proportions, in which the steam passages are rammed with the steam chest core and also the greater part of the exhaust passage. The only portion required to complete it being a plain outlet branch core that later is set in a print impression provided by the pattern. The piece of blocking in the exhaust portion represents the metal thickness in the cylinder body. The pieces that form the passages are doweled on the bottom board and are steadied at the port end by a strip, shown broken, extending from one end of the box to the other. Two short strips, one of which is shown at right angles to the broken strip, holds the top facing against which the valve works. The lower facing is nailed to the bottom board.

Fig. 27 shows a corebox for a double ported slide valve. It consists of a frame enclosing a longitudinal block of a *D*-section representing the metal around the recess in which the valve rod lies, two blocks that provide the openings for the outer ports and the central exhaust. The different features will be more readily apparent by referring to the section of the mold shown in Fig. 29. The inner ports shown in this view are made in another corebox.

Corliss Cylinder Ports

A corebox for forming the steam passages in a corliss cylinder is shown in Fig. 28. The side section and end view show the box complete, but the plan is shown with the upper portion removed. The seatings for the valves are cut in the wing pieces, divided along the center and with the upper parts carried on battens. The exhaust opening shown in the side view is cut in a loose piece. Two long, narrow prints are put in the box to receive the short port cores. The core with the ports inserted is shown in Fig. 31 supported on a wire grid and with the vents brought out at the ends of the valve seatings.

Fig. 30 illustrates one of the coreboxes for a condenser. It shows the provision made for the cylindrical body of the pump, within which in the mold the core for the pump bore passes. It also shows how the shouldered portions of the core made in the box, are formed with a strike worked along the shouldered edges instead of more expensive wood blocking which would have to be fitted. Fig. 32 shows how provision is made for carrying cores to form seatings for the pump valves. This method is better than the usual one where each seating core is placed in a separate print impression in the main core. The loose pieces top and bottom deliver with slight taper. If they were thick it would be better to joint them down to the center.

Casting Pure Nickel

To the Editor: In the Feb. 1 issue of THE FOUNDRY, there is an article "Castings of Pure Nickel Are Possible," on which I should like to comment.

The author is correct in stating that castings of commercially pure nickel are possible. We have made quantities of just such castings. However, I am doubtful if the proper fluidity for casting is entirely a matter of temperature. It is invariably necessary to add from 0.75 per cent to 1.00 per cent manganese to secure sound castings which will be free from spongy spots. This addition of manganese must be made as manganese metal and not as ferromanganese, otherwise the iron content will be too high. The manganese thus added is not in any sense used as a deoxidizer. It is purely an alloying element.

The molding should be done in a fairly open strong silica sand and only dry-sand casting should be attempted. Skin drying will not be satisfactory.

Best results from crucibles are obtained if brass pots are used and not steel pots. Steel pots are too dense and will not stand up as many heats as brass pots. Nickel will not take up carbon from a graphite pot, and as a matter of information, I might say that it is rather difficult to introduce carbon into molten nickel in any manner.

I differ with the author as to the proper method of deoxidation of the molten nickel. There is only one correct method that will insure positive results and that is to use magnesium metal, about 1½ ounces to the hundred pounds. Nothing else will insure perfect castings unless an alloy of nickel and magnesium is preferred. This deoxidizing alloy is preferably a 50/50 alloy of nickel and magnesium.

C. B. CALLOMON,
Driver-Harris Co.,
Harrison, N. J.

Size of Sand-blast Sand

Question: Kindly advise the sizes of sand used in sand-blast operations.

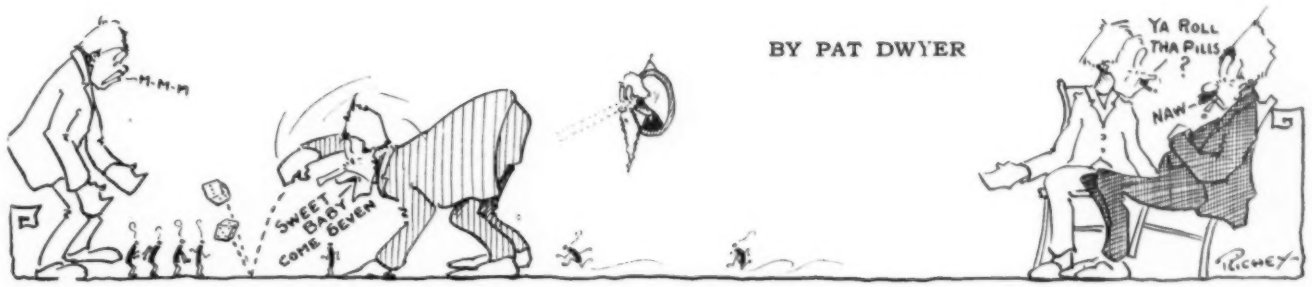
Answer: No standard has been universally adopted but the following limits as used by a prominent sand producer give an idea of the sizes used for different purposes. Sand which passes a screen with 0.17-inch mesh and is rejected by a 0.15-inch mesh is used for sandblasting steel castings. Sand which passes an 0.15-inch mesh and is rejected by a 0.084-inch mesh is recommended for steel and heavy gray-iron castings. Sand passing an 0.084-inch mesh and rejected by a 0.043-inch mesh is recommended for sanitary ware, stove plate and light gray-iron castings.

Will Expand Facilities

Directors of the United States Cast Iron Pipe & Foundry Co., have decided in favor of an appropriation for the expansion of the company's Birmingham plant to permit the installation of additional machines for producing cast iron pipe by means of the centrifugal process. In addition, a 10-machine plant will be installed at the company's Burlington works.

Bill Makes Column Bases in Green Sand-I

BY PAT DWYER



FROM a superficial knowledge gained through idly watching a game occasionally, I should not feel inclined to classify crap shooting as a scientific game. So far as I know, no person, white or black has come forward with a defense to the effect that the game is a form of athletics and, beyond promoting a certain finger snapping speed among its devotees, I never have heard any person advance the claim that it is a game of skill. The fearful and wonderful phraseology employed by those taking part in a game should prove a never ending mine of information and pleasure to one interested in the contortionist branch of the English language.

However, the game presents one feature of irresistible appeal to any person afflicted with the gambling spirit. It is speedy. No long drawn out suspense. Lots of action. Snappy, that's the word. I trust that it is not necessary for me to say that I am not quoting from my own experience. In a general way I harbored an impression to the foregoing effect, but I am indebted to Bill for expert confirmation. We attended a little party one night last week and I think Bill wasted the whole evening rolling the bones with a few congenial spirits.

On the way home I told Bill it was a pity to see grown up men acting in such a silly manner and he defended himself by stating that whatever gives a man pleasure is not silly.

"When it comes to acting silly," said Bill, "how about yourself? I am sure you spent over an hour talking to a solemn faced bird who runs a plumbing shop and pirate emporium down at the corner."

I admitted talking, but violently objected to the claim that I had wasted the time. The plumber was a most interesting conversationalist and had gone into great detail on the relative merits of vent and ventless sanitary installations. Before he was through talking I had learned that if possible there is a greater lack of uniformity in the plumbing than there is in the foundry business. Every city and state has a code of its own and these codes are subject to change with every incoming administrative body so that master plumbers constantly are between the devil and the plumbers' union.

"Perhaps he was right," said Bill. "I don't know much about plumbers except that it is the part of wisdom to shun them as far as possible. It is a pity the custom of employing emblems has died out. In the older time, I imagine the craft was represented by a woodcock—you know, one of those birds with a bill the size and general dimensions of a fountain pen—a woodcock rampant on a field *rouge* to represent red lead, the whole surmounted by a pair of stillson wrenches *argent* and the motto 'Better late than never.' I am surprised to learn that their methods lack uniformity and seriously doubt their eligibility in the same class as foundrymen. For example, consider one typical job, a casting for a column base.

"Several methods are available for making the usual style of column base in which a large plate is connected to a smaller by a central hub and a number of brackets symmetrically spaced. The one selected will depend to a considerable extent on local conditions including size and weight, available shop equipment and other items of that character. For example, a certain method may be perfectly feasible in the hands of a skilled molder and yet produce nothing but scrap in the hands of a novice. Therefore, it is apparent that one of the most important features to be taken into consideration when deciding on the adoption of a certain method, is the ability and experience of the man to whom the job of making the mold is intrusted. If a man only is familiar with the rolling-over method of making a mold, clearly he will experience difficulty and probably produce a waster on his first attempt to *bed in* a pattern. The advantage of the bedding-in process lies in the fact that in many instances it is possible to dispense with all flask parts excepting the cope. Sometimes the casting can be made without even a cope.

"Column bases usually are set on concrete and, therefore, no particular advantage attaches to a nice, smooth face secured at the trouble and expense of ramming a cope on the mold. To all intents and purposes the surface of a casting poured in an open sand mold is equal to the surface of a casting poured under a cope and it is only foolish prejudice and in many cases common ignorance on the part of the customer that insists on a perfect plane surface on a casting to be buried in concrete. Frequently a little friendly conference between the foundryman and the customer will clear up misunderstandings of this kind and result in a general saving all around. If the foundryman is relieved of the necessity of ramming a cope he can afford to shave the price and make a greater tonnage in a given time. However, that is not a point with which we are concerned at the present moment. The almost universal custom is to pour castings of this kind under a cope and now that we have formally entered a protest we shall consider the question pigeon-holed, the usual fate of formal protests, and continue the description on the assumption that copes are employed.

"Before relinquishing the subject entirely, it is only fair to point out that if the casting is to be poured in an open mold it can be molded and leveled more readily by the bedding-in process than by rolling it over. Also, a certain amount of risk attaches to one of these rolled over molds whether or not it is covered afterward with a cope. It will be noted that the green sand pockets between the ribs are anchored firmly to the bottom and sides. Where the pattern is bedded in, these pockets remain intact and firm and thus are in a position to resist the upward pressure of the molten iron in the base which undermines them. Where the mold is rolled over, a certain amount of distortion takes place before it finally

is leveled unless the flask and bottom board or plate are unusually strong and rigid. Some times this distortion opens a crack at the base of the pockets and the result is that when the pressure from the molten iron is applied beneath, they float away in whole or in part.

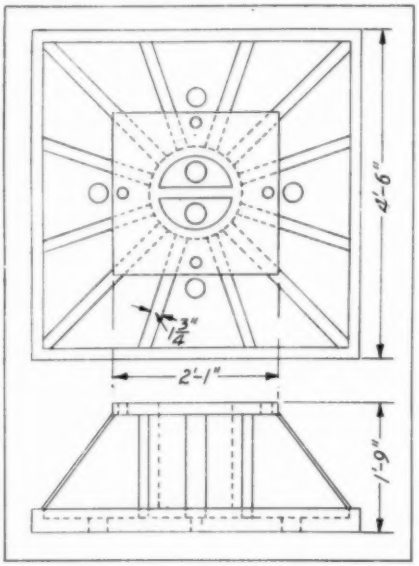
"Where a considerable number of these castings are ordered a permanent level bed may be put down and thus relieve the molder from the necessity of adjusting a level bed for each mold. This feature practically is the same whether the pattern is bedded in the floor or rolled over in a flask, and consists of a pair of long rails adjusted level and parallel on blocks and wedges and then surrounded with rammed sand to hold them in place.

"Foundrymen generally are familiar with all the foregoing features so I shall touch upon them no further at this time, but will confine myself briefly to an outline of three or four methods illustrating how column bases may be handled under varying conditions. The first two methods show how the mold may be made entirely in green sand. In the third method shown, a pair of dry sand cores is employed to form the small base. The remainder of the mold is made in green sand.

Pattern in Two Sections

"Irrespective of which method is adopted, the pattern will have to be made in two sections; one comprising the large base and all the brackets, the second consisting of the small base and the center core print. Another feature common to all methods is that the small base is molded down, that is in the lower part of the mold. Where the rolling over process is practiced the surface of the large base on the pattern presents an unbroken surface, but where it is customary to bed the pattern in the sand, suitable openings are provided through the upper base pattern through which the molder may tuck sand up under the rim and into the corners of the pockets between the brackets. These openings also furnish a ready means for venting the pockets thoroughly before the pattern is drawn.

"Where the mold is to be rolled over, the large part of the pattern with the brackets attached is placed on a board and surrounded with a drag deep enough to extend beyond a small auxiliary cope or cover employed to cover the small base before the drag is rolled over. It is not necessary that the entire drag should be in one piece. It may be made up from two or more sections. The lower section is placed on the roll-over board and the additional section or sections, added as the ramming progresses. If it is customary to pour the casting from one side, the pattern is disposed accordingly so that the gates will have an ample margin of sand behind them. A little more trouble is involved in making up a pouring basin to pour the iron through several small pop gates located above the space between the center core and the inner ends of the green sand pockets; but this style of runner reduces the hazard of a runout, gives a more even distribution of the metal and fills the mold more satisfactorily than any other. It may be applied with equal facility



PLAN AND ELEVATION OF COLUMN BASE

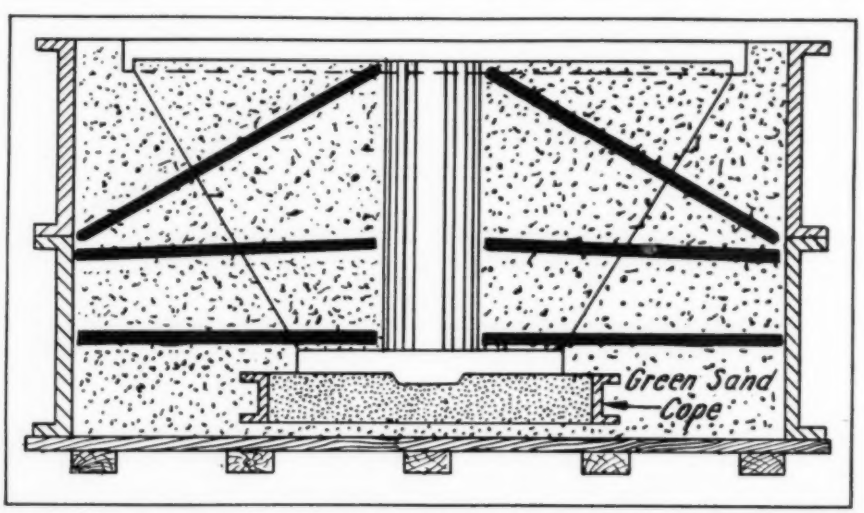
to an open mold or one that is covered by a cope.

"Facing sand to a depth of about 1 inch is riddled over the face of the pattern and spikes with the heads covered with claywash or paste are placed upright in the corners. A course of black sand is shoveled into the drag to an approximate thickness of six inches and rammed quite firmly in the space between the outside edge of the pattern and the wall of the flask. The sand immediately above the pattern is tucked with the fingers around the brackets and then tramped off lightly. The sand on the upper part of these pockets must be left quite soft, otherwise the steam cannot escape readily when the pockets are covered with iron and the casting will come out covered with scabs.

"Two or three long rods are laid horizontally on the sand between each pair of brackets with the inner ends approaching closely to the round hub and the outer ends extending to the walls of the flask. These rods together with two subsequent rows, serve as anchors to hold the bodies of sand that fill the spaces between the brackets and should not be skimped in length. In fact, it is better to have them too long and then the ends may be turned up where they come in contact with the walls of the flask. These turned-up ends also exert a certain amount of leverage and help to anchor the pockets more firmly in place. Where the pockets present an unusual amount of overhang, it is advisable to lay a few long rods at right angles to the others on each course and in this manner bind the body of sand surrounding the brackets more firmly together.

Cast Iron Grating

"Under certain conditions a cast-iron grating or arbor, especially on the last ramming is preferable to a row of loose rods. The main objection to its use is that it must be broken to remove it from the casting. Of course, a grating might be employed in a modified form so that the fingers need not extend beyond the edge of the small base. In that case long rods would be employed to extend into sharp corners of the pockets and the arbor simply would take the place of the transverse rods pre-



SECTIONAL VIEW OF DRAG MOLD SHOWING POSITION OF ANCHOR RODS AND SMALL GREEN SAND COPE EMPLOYED

viously mentioned. An arbor of this type may be removed from the casting and with reasonable care will last indefinitely.

"Succeeding courses of sand are rammed and rodded in a similar manner until the flask is filled to the top of the brackets. The sand is scraped off flush at this point and the rods or the arbor, as the case may be, are rapped down into place about ¼-inch below the surface. A space corresponding to the area of the small base then is made by hand, flush with the top edge of all the brackets. The edge of each pocket is filleted and nailed and in the event that the facing sand is weak in bond, the entire face is nailed. The surface then is blacked and each bracket is rapped before the small base is lowered into place. By rapping the pattern at this stage the molder can observe if any of the sand edges have loosened and can take the necessary steps to prevent the sand from falling after the mold is rolled over. Further, it is apparent that no matter how much the pattern is rapped after it is rolled over, the effect will not extend to the ends of the brackets and, therefore, this preliminary rapping facilities the drawing of the pattern.

"Patterns of this character should be drafted liberally so that they may be pulled out of the sand easily. This practice of rapping patterns furnishes a curious commentary on the influence of custom and tradition in the pattern shop and foundry. In fitting a pattern to be molded on a machine, no provision is made for rapping it and yet if the same pattern was made to be molded in the ordinary manner on the bench or floor, the patternmaker would consider it strictly necessary to attach rapping plates and the molder would feel in duty bound to use the rapping bar and hammer before he attempted to lift the pattern out of the sand. Under certain conditions it may be necessary to rap patterns, but in the great majority of cases if the patterns are constructed properly they may be drawn out of the sand without any rapping beyond that furnished by a vibrator or its equivalent. Many molders do not seem to realize that a pattern is a piece of equipment to assist them in making a mold and that it is to their own interest to keep their equipment in the best condition. They smash the inside with a sledge hammer and rapping bar and they mark the outside with the vent wire.

"Sand is rammed around the small base and scraped off flush with the upper surface, where a parting is made to receive a shallow cope or a slab core. A slab core or a loamed plate in one or more sections depending on the area to be covered and large enough to present ample bearing surface beyond the mold cavity, is better than a green sand cope for this purpose. It is easier to prepare and apply and insures a nice clean face on the casting. A green sand cope will prove satisfactory provided it is handled with proper care and by a man who knows its limitations.

"After the cope has been rammed, or the core fitted, as the case may be, it is lifted off and the mold is vented. Horizontal vents are taken from under the small base and vertical vents are driven down between the brackets. If the sand is *close* it may be necessary to spread a layer of cinders over the vent holes, but this at best is only an emergency measure and besides it is a nuisance if several castings are to be made on account of the manner in which the cinders become mixed with the sand each time a casting is shaken out. The better way is to employ sand that is sufficiently porous to vent freely without the aid of cinders.

"The sand around the edge of the small base is slicked down a trifle so that the cover shall not bear too heavily, then the pattern is drawn out of the sand and the cover replaced. The remainder of the drag is filled with sand, rammed, fitted with a bottom board, vented, clamped and rolled over. Since the small base pattern no longer is in the mold, it is apparent that the flask must be rolled carefully and for the same reason it is evident that the flask and bottom board must be strong and rigid and placed on a level bed or foundation to prevent distortion.

"The cope may be rammed on top of the drag, but a certain amount of risk attaches to this practice since the jarring may loosen the sand on the bottom of the pockets overhanging the cavity in the bottom of the mold. The surface of the large base usually is perfectly flat and, therefore, it is quite feasible to ram the cope on a flat board or plate. The position of the gates may be indicated on the board by chalk marks or in any other suitable manner. The casting may be poured through two gates cut in the rim opposite two of the central brackets, but, personally, I prefer to pour castings of this kind through a few small pop gates spaced around the center core. A 1-inch riser taken directly off the top at one corner will serve to indicate when the mold is full and also reduce the pressure on the cope due to a high pouring basin. By arranging an overflow channel from the riser, it will drain all the metal remaining in the pouring basin after the mold is filled.

"If the mold is not well vented or if the pockets are rammed too hard on top the metal will kick and blow and the casting will be covered with scabs and the upper face will be filled with dirt. In addition to the vents placed in the sand before the drag is rolled over, a row of horizontal vent holes is formed around the joint of the mold before the pattern is withdrawn. These holes assist materially in removing gas and steam from the sand when the pockets are covered with iron. With due care and in the hands of an experienced molder this method may be employed to produce satisfactory castings. It is purely an individual method and would not be employed, for example, where only handymen are available or where it may be necessary to produce large numbers of duplicate castings on a production basis."

"Seems to me," I said, "that this foundry business presents almost as many uncertain angles as a crap game."

"That just goes to show," said Bill, "how little you know about the ancient and honorable African pastime. In a crap game you only lose all you have. In the foundry it is possible to lose something you never had."

THE JOLLY GOOD FELLOW WHO WARBLES SO GAILY THAT HE WON'T GO HOME UNTIL MORNING, SOMETIMES FINDS IT NECESSARY TO GO HOME IN A BARREL.

Select Sand for Brasswork-II

Advantages of Steaming Process in Preparation of Sand Pile Described— Fine Sand Not Suitable for Large Castings but May Be Treated To Serve Satisfactorily

BY CHARLES VICKERS

CARBON is picked up by sand during the course of its active life and in conjunction with the change occasioned by the burning of the bonding material turns the color of the sand from yellow or red to black. A carbon film adheres to the clay coating covering the grains of silica and as the carbon does not absorb water readily it insulates the clay against the water, thus acting in a manner similar to that of the parting material on the joint of a mold. This substance, in many instances is composed of carbon in the shape of pulverized charcoal mixed with rosin. The binding property of the clay in the molding sand is decreased by the carbon envelope and as a result the sand is proportionately weaker. This condition exists in the case of all molding sands when they become deep black and then ordinary tempering methods, cutting over and riddling, fail to develop the full strength of the bond.

Sand that has arrived at this stage may be tempered by steaming. This method involves a combination of heat, time and moisture and will produce results not obtainable in any other manner. The sand is mellowed to the consistency of moist brown sugar in which each grain clings to the others. Sand treated in this manner not only insures a maximum number of unbroken lifts and pattern draws but it also is permeable to gas with the result that blows and scabs practically are eliminated.

Hot Sand Dangerous

Frequently the difference between bad luck and good luck in making bronze castings lies in the treatment accorded the molding sand. To temper with steam, the molds must be shaken out while hot, then the sand is sprinkled with water in the usual manner and preferably riddled while hot into a cone-shaped pile which then is covered to a depth of an inch or more with cool, tempered molding sand. When this has been done the cool sand is patted smoothly from top to bottom with the back of the shovel and then the patted sand is watered uniformly and left to cool. This treatment puts a shell of steam proof cool sand on the pile and gradually the steam penetrates the layer of a carbon around each grain and properly dampens the ferruginous bond until it has assumed the full degree of plasticity.

Facing for Tablets

Sometimes the hot sand merely is shoveled into a pile and treated as described, but the riddling breaks all the lumps and contributes to a better tempering of the sand. This method always should be followed when mixing facings for important castings and especially for tablets having deep lettering and scroll work, because in such cases a very tough sand is required. Facing sand is prepared by burying large, hot castings or heated ingots in the moistened sand, then shoveling or screening it into a pile and proceeding as outlined. Unless used rapidly as in the case of machine molding, the moisture should be prevented from evaporating from the unused portions of the sand pile by first patting them and then sprinkling the surface with water. A sand pile used by a jobbing molder gradually will dry out at the rear or at the top and this should be prevented by the foregoing process. Otherwise the bond in the sand will be weakened by the gradual evaporation of the water and toward the close of the day, difficulty will be experienced in lifting copes and drawing patterns.

The method of tempering molding sand by steaming has been in use by careful molders for many years, but it is not as universally known as it might be. Superior strength of the sand, due to the more uniform distribution of the water bond is a great aid in cutting down production losses. The time consuming wait for the sand to cool might be urged as an objection in some cases but foundrymen who do not wait, but use hot sand to back up the cool sand that necessarily must be put next the pattern, pay for their haste and mistaken economy in the matter of a little sand by enjoying a heavy discard in the shape of porous castings revealed during machining operations.

Porosity is caused by steam from the hot sand backing and working through into the mold and condensing in drops on the cool sand facing and on the cores set in the mold. The sand should be permitted to do its own steaming before it is packed into a mold and it should be at normal atmospheric temperature when used. Economizing with molding sand is poor economy, because no casting can be better than the mold in which it is made. Hot sand or badly tempered sand is the source of many troubles usually credited to other causes.

Only one grade of sand is in use in many foundries and it is expected to produce any class of castings. In fact the sand and its fitness for the job usually never is considered when the cause of continued loss, due to defective castings is being investigated. The grade of sand used in a brass foundry will have been selected originally because of a peculiar fitness for making the class of castings constituting the backbone of the work done there. The finest grades are found in shops making light, finely finished castings and the coarser grades where the heavier work is done. The kind of work carried on in a shop usually reflects the training and experience of those responsible for starting the business. Every person is more or less of a specialist and only rarely is one found equally expert in making large and small castings.

Different Grades of Sand

Where heavy castings and high grade small castings are made in the one foundry, different grades of sand must be kept on hand and also molders accustomed to their use. Where the majority of the castings are small and light a separate floor or floors for molding the heavy work should be provided, equipped with conveniences for handling the molds, for securing them against pressure of the metal and for transporting the molten metal to the molds and pouring it.

Unless proper equipment is at hand it is not advisable for a light work shop to bid for such business. No profit will be made and indeed the foundryman may consider himself fortunate if he does not sustain an actual loss due to a number of defectives made before securing a casting that will pass.

The adjective heavy as applied to brass castings is comparative and means a casting larger and weightier than customary. A heavy casting in one shop might be a light casting in another. In the one place its production would necessitate careful planning and molding and great ingenuity in melting the metal and getting it into the mold. In the other place not the slightest ripple of excitement would be caused by work carried on as ordinary everyday routine practice.

The actual weight of what may be termed heavy castings may range from a few pounds to thousands of pounds. In many cases a better term would be massive, because a relatively small casting, thick in section, might prove a difficult object to cast in a sand that produced satisfactory castings of equal weight, but of thin section and of course larger area. When sand adapted for making massive castings is used to make molds for light weight castings difficulty usually is experienced in getting the required smooth surface. The castings are rough and will present many little file-like protuberances on the surface produced by the molten metal pressing into the interstices between the coarser grains of the sand. These also exist on the surface of the heavy casting, but because of its massiveness are not apparent.

Heavy Castings

Rough, also is a relative term when applied to brass castings. What one man might consider rough, another man would regard as smooth. In its superlative sense the term smooth means a fine finish not attainable in shops equipped to make the more ordinary kind of smooth castings. However, in this latter case it is not so much a question of fine sand as it is the application of special methods in making the molds. Special methods require time and a peculiar degree of skill, therefore, the very high grade, finely finished castings cost more to produce than ordinary castings of equal size and weight.

The application of the same methods in a foundry equipped with the coarser grades of sand will produce ordinary, finely finished castings, but it will be more expensive to make them on account of the additional labor involved. Where a massive casting is to be made in a sand too fine for it, success will follow the use of a special facing sand next the pattern supplemented by a liberal application of the vent wire in the backing sand. It is possible to make castings outside the regular scope of any foundry by taking certain precautions that necessitate extra work and as a result they will cost more than the ordinary run of castings. In consequence of the extra time consumed in making such castings it follows that it does not pay to compete against those especially equipped to produce it.

Bid for Unsuitable Work

While there is no hard and fast rule drawn between those known as light and heavy castings, it is apparent that a heavy bushing or a pump cylinder lining will be out of place in a chandelier shop. It will cost more to make it there than in places equipped for such work. Chandelier, electrolier and other finely finished castings will be equally out of place in a heavy work shop because while it may be possible to make them the increased cost will absorb the profits and in some cases—as many have learned to their cost—leave a deficit. Sometimes the pathetic spectacle is presented of those whose regular business is the production of light castings eagerly grasping at the chance to make heavy castings. The heavy foundry experiences an equally powerful temptation to bid for small, delicate work. Judging by the prices quoted so frequently in such cases one is led to wonder regarding the extraordinary attractiveness of a business that charms men to engage therein apparently for the sake of their health.

Molding sands usually are graded by number, the classification being in ascending order of grain size from No. 1 to No. 5. Sometimes mixtures of two or more different numbers show better results than one number. Grades of sand finer than No. 1 are classified as No. 0 and 00, the latter being a very fine grade. Prepared facing sands also can be obtained from any foundry supply house and these usually are of a very fine grade. Exceedingly smooth castings, patterns, etc., where made from metals of low melting point may be cast in molds made of the silica flour used so extensively as a wash for steel casting molds; also they may be cast in molds made of plaster of paris.

It does not follow invariably that a fine grade of sand will produce a smooth casting. The fine facing sand known to the trade as Windsor Locks has been known under certain conditions to prove a disappointment in producing smooth castings. This was due to no fault of the sand, but to the manner in which it was prepared for use. If the remarks made in this article about the importance of the proper distribution of the water are kept in mind and the procedure suggested followed, the results will be satisfactory. A sieve of fine mesh must be employed when screening sand on to patterns and the sand must not be damp enough to require rubbing through the sieve by hand. This method will agglomerate the grains into little beads which the ramming will flatten against the pattern and leave little irregular cavities at their boundaries into which the metal will flow and produce a rough surface on the casting.

Fine molding sand for facings usually are dry and powdery and water must be added before they can be used and to temper them properly requires time. In foundries specializing in fine castings where a finished surface is an important requisite, it has been discovered that the facing sand must be prepared at least 24 hours before it is required. Great care is taken in the preparation of the sand used next the pattern. New sand and old sand are mixed in various proportions to form the facing a considerable time in advance of the time it is needed. Before the mixture is made the new sand may be milled, then dried and passed through fine screens to remove all the lumps.

Printing Back the Pattern

In addition to these precautions it sometimes is necessary to print back the patterns to close up all the microscopic crevices between the sand grains into which the metal might enter. The impression produced by the pattern is coated with a thin layer of fine sand or other material, then it is closed on to the pattern again and partially re-rammed to bring out a sharp imprint from the pattern. This treatment cannot be applied to vertical surfaces as the dusted-on material would be scraped off while closing the mold. Printing back gives the best results in the case of a flat object carrying letters, scrolls or moldings and it is more easily applied to a cope than a drag surface. The cope is lifted off, the pattern is cleaned and the sand impression in

the cope is first sprayed with water, either plain or containing a little adhesive such as molasses. The spray must be divided finely for if drops of water are spilled on the face of the mold, part of the impression may be ruined. The object of the spraying is to increase the strength of the facing sand, also to provide moisture to penetrate the layer of dry sand that is next dusted on to the impression through a fine mesh muslin bag.

Mold Is Skin Dried

The dry sand may be a special facing sand bought ready made, or it may be prepared by slightly burning some of the new molding sand and then passing it through a fine screen when cold. The dampened impression of the mold is covered with a 1/16-inch thickness of prepared sand, then the cope is replaced on the drag, a part of the backing sand is scooped out and additional sand placed thereon, after which the mold is rammed and finished by a careful and uniform butt ramming.

To prevent a mishap which would ruin the mold it is necessary to apply parting material on top of the dusted-on sand before the mold is closed for reramming. The operation of printing back comprises lifting the cope, spraying the surface with water, dusting on dry fine sand, dusting on parting material, closing the cope, reramming the mold, relifting the cope and slightly dusting with fine flour. Just before the mold is ready to pour it must be skin dried with a torch until the flour is uniformly toasted brown. The skin drying is required on account of the additional water applied by spraying and also because of the additional hardness imparted to the face of the mold by the reramming.

When the drag half of the mold has to be printed back it may be necessary to draw the pattern therefrom after the cope is lifted and to treat the drag the same as the cope with water, sand and parting compounds. The pattern is replaced, the cope closed, the mold rolled over, drag rerammed, mold rolled back and the cope rerammed, then the mold is opened and the pattern removed. This method of printing the pattern in the drag never is as satisfactory as when the form permits the drag to be lifted off like the cope. In the latter case the flask pins are a sure guide to the exact replacement of the mold on the pattern. The mode of procedure is to bed a bottom board on the cope after it is finished and before it is lifted off. The mold is rolled over, the drag lifted and finished by the spraying, dusting and ramming process, then the mold is rolled back and the cope is lifted and treated and the pattern is drawn.

Where the printing back process cannot be employed—and it is well to remember that it is not applicable to all patterns—a smooth finish on the surface of the casting only can be obtained by the use of a fine facing sand applied next the pattern to produce a smooth, even surface. Sometimes what is known as French sand is used. It is prepared by grinding or milling varying proportions of new and old sand of the same approximate grades.

Printing back produces satisfactory castings for die molds where one side carries scroll work and must be exceedingly smooth, but where smoothness on the other sides is not so important. Such castings frequently are rather massive and the smooth face should be molded in the cope and printed back with beam dust which seems specially fitted to impart the required smooth finish. This dust may be collected from the beams and ledges of the foundry walls. It is an almost impalpable powder thrown into the atmosphere when the castings are shaken out and the sand watered. It is air floated sand and produces a surface as smooth as a metal mold on a printed back mold.

Other methods of producing fine surfaces on molds and castings made in foundries using No. 1 or 2 molding sand which ordinarily would not produce the required surface, is to pass equal parts dry new and old sand through a fine screen and mix one part good flour with 20 parts sand, temper and use as a facing. The addition of flour to ordinary No. 1 molding sand in proportion of 1 flour to 20 sand and even 1 to 15, will produce a much smoother surface than otherwise is possible. This facing sand will not cut or scab and its use is specified in cases where a massive casting is to be attempted in a fine sand.

Smooth Die Molds

Where massive castings have to be made occasionally in shops equipped only with a No. 0 brass sand the following mixture has been found satisfactory:

New No. 0 molding sand 10 parts
Fine sharp sand (silica preferred) 5 parts
Ground fire clay (China clay preferred) 1 part

This sand is mixed thoroughly and allowed to stand 24 hours before using. The vent wire should be applied liberally to the backing sand and the result will be sound, clean castings.

Color of Castings

This facing should be used for round copper bars from 1½-inch diameter upward and other castings of a similar character, unless a grade of sand coarser than No. 0 is used. Treatment of this kind is essential where the copper has to possess high electrical conductivity and where the margin of safety between sound and porous castings is very narrow.

Large and massive bronze castings present a dirty greenish color on leaving the mold, except when plumbago has been employed to the mold surface and then the castings will appear almost black. Phosphor bronze castings always are black when the percentage of phosphorus is sufficient to produce a very fluid metal. When a massive casting, even though only weighing 3 pounds, comes from the sand with a smooth surface and a nice orange color, it may be regarded with suspicion. It has been poured too cold and that fact coupled with the fine grade of sand responsible for the smooth surface almost invariably will ensure a crop of holes under the skin and only revealed after machine work is done. A massive or chunky bronze casting can be cleaned to appear smooth and pleasing, but as it comes from the sand a fin or two here and there is a pretty certain indication of a good, honest casting that will journey to the machine shop and continue right along on its career of usefulness, instead of returning to grace the scrap pile.

Surface appearance of the casting as it leaves the sand is not so important in the case of a large casting, but apparently appearance counts a great deal in the opinion of the customer in the case of valves and other small castings. It is not sufficient for the casting to be sound, it also must resemble an orange in color and should this color be lacking the casting may be rejected.

A dark unsightly color on small red brass castings is considered a reflection on the quality of the metal that has been used. This color is not always the fault of the metal mixture, or an indication that scrap has been used instead of the new metal every purchaser of brass castings imagines he is entitled to regardless

of the low price he expects to pay. Sometimes the molding sand is responsible. Which constituent of new molding sand spoils the color of a small brass casting never has been determined. The subject has received little attention from investigators. Practical foundrymen know that some sands, while excellent for aluminum or gray iron, cannot be used for small brass castings because of their effect on the color of the finished product.

Usually a new brass molding sand will turn out a casting of good color, orange shading into yellow, but after the sand has been used for some time the color of the casting is not so satisfactory. This is due to some organic impurity usually used as a binder for brass casting cores. Irrespective of what binder is used the core prints never should be allowed to enter the molding sand to disintegrate and become a component part thereof. When it is found impossible to get a suitable color on the surface of the castings it may be taken as an indication that something of the kind is going on and the practice should be stopped. To bring back the color it will be necessary to add sufficient new sand to thoroughly renovate the sand pile. Oil in the sand will produce a blue skin on aluminum bronze and manganese bronze and for this reason starch binders are to be preferred for the cores.

Sea Coal Facing

Sea coal seldom is added to facings for heavy castings, but sometimes it can be used to advantage on brass castings. The following mixture has been used for facing on 500-pound bronze castings containing ridges easily washed away. Equal parts new and old molding sand mixed dry with sea coal in the proportion of 1 part sea coal to 8 parts sand and afterward dampened with a strong solution of molasses water. The mold was dried before it was poured

A thorough mixing of the sand is important, either for mold facing or for cores and a sand possessing little bond can be made tough by milling. Milling the core sand economizes on binder, thus a sand mixture that would require one part oil to 45 parts sand or less when mixed with shovel and riddle, can be mixed one part oil to 60 parts sand by machine and in addition the machine-mixed sand will make a better core. Facing sands are greatly improved by milling, but in the absence of the proper machinery they should be given time to mature, or the steaming process should be adopted wherever this is practicable.

How and Why in Brass Founding

By Charles Vickers

Desire High Finished Brass Castings

We are making an ornamental red brass castings shaped like an eagle into which is incorporated a motormeter. These castings must be of exceptional quality, and the feathers on the eagle must be clean cut and sharp. We are using our regular molding sand, but are anxious to learn of any better sand for this purpose that you would recommend.

Producing finely finished brass castings is 80 per cent molding and 20 per cent metal. Use a red brass of about 6½ per cent zinc, 3½ per cent tin and 2½ per cent lead, the remainder copper. This will give a mixture with a fine color. That settles the melting part of the problem.

The molding is a question of skill, and the writer knows where all the advice that could be given did no good, because skill in molding was lacking, then the one giving the advice got the blame. A fine grade of sand procurable from advertisers in THE FOUNDRY is Windsor Locks. Also fine sand can be made in the foundry and a good way is to dry some of the new sand used for regular castings, at a gentle heat, then mill it thoroughly, until it is as fine as flour. To make the facing, dry some used sand, screen through a fine riddle, add one part of the latter to two parts of the milled new sand, and to this add flour one part to 20 parts sand. Mix and again riddle, then temper with clean water. Now after it is tempered, place it on a board and roll it with a rolling pin until it is strong and tough. Use the above for a facing, ram the molds rather soft, and after lifting off the cope spray it with molasses water, then dust over the impression, some of the milled dry sand through a salt bag; on top of the dusted sand dust parting liberally then replace the cope and butt ram the mold. If the pattern can be rolled out, roll the mold over and do the same with the drag, but if it cannot be rolled out, then lift off the cope, and reprint the pattern. Usually when the pattern must be printed back it is done before the cope is printed then one ramming does for both. Dust a light coating of flour on the finished molds, then torch them just before ready to pour.

Run Experimental Heats To Find Trouble

We want information on aluminum alloys for light castings. We are using a 99 per cent remelted aluminum, and adding 12 pounds of 50-50 copper aluminum alloy to each 100 pounds of the remelted stock, but the castings come with shrink holes and draws, and also sometimes are badly pitted. We have to pour at 1440 degrees Fahr. to run the castings. We also find that cracks come frequently. Would you advise the use of silicon instead of copper?

It would be advisable to have an analysis made of the 99 per cent aluminum to determine just what it really is. Then you will not be working in the dark. We presume the secondary aluminum is used from motives of economy, but if castings are lost because of it, then it becomes poor economy. To determine this point, procure a supply of new commercial aluminum and make a few trial heats of the following mixture after having first made your own supply of the 50 copper, 50 aluminum alloy for these trials: Melt together 82 pounds aluminum, and 6 pounds of the 50-50 hardener and when liquid, add 15 pounds good grade zinc, stir well and pour when hot enough. Make the same alloy using the 99 per cent aluminum in the same manner as the pure aluminum and run the same number of heats, then compare the results. For your castings the 15 per cent zinc alloy is just as good as the copper aluminum alloy and cheaper and there is not the slightest doubt about its running the castings perfectly. A temperature of 1440 degrees is high for any aluminum alloy. If the castings are made so thin they will not run at a lower temperature, it will be necessary to take losses due to cracking and draws.

Permanent Pit Proves Worth

Introduction of Properly Designed Permanent Pit with Binders and Plates Saves Time and Produces Accurate Castings Which Meet Customer's Requirements

BY J. H. EASTHAM

AFTER seeing many small jobbing foundries which make castings up to about 3000 pounds in weight, and sizing up their methods, one arrives at the conclusion that their slogan should be *The old order changeth, and giveth place to the new.* Many of them are equipped with a good crane, cupola, core oven, and moderately up-to-date cleaning facilities, but they are lacking in flask equipment and ways of molding their larger work.

An instance comes to mind in the example of the paper carton machine bedplate illustrated in Fig. 1. This at

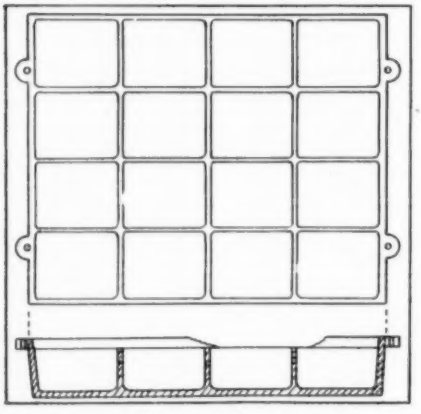


FIG. 1—BEDPLATE CASTING FOR A PAPER CARTON MACHINE

one time was handled under archaic conditions at a heavy loss, but easily was made a paying unit when a little thought was given to its manufacture. The casting when cleaned weighed 1100 pounds. It was oblong and was intersected by three cross ribs each way forming 16 pockets, each 8 inches deep. These, from the design of the casting were carried in the cope, an old wooden flask, only two inches wider than the pattern, but nearly twice as long, being used. This flask was a most accommodating affair, inasmuch as either cope or drag part would bend to almost any shape when suspended from the crane, or while being turned over preparatory to closing.

Consequently, cracks developed in every cope when turned over, several castings being lost through drops, and a number rejected by the customer as being too crooked to machine. Six out of seven delivered were sent back as useless on the latter account. However, a change of supervision in the foundry brought corresponding changes in methods. The bedplate job under discussion was tackled first with beneficial results.

Three pit binder castings of the design shown in Fig. 2 were made without a pattern in opensand molds, and afterwards set up at equal distances in a hole opened in the foundry floor. Three flat plates of convenient size were laid on their upper faces, sand rammed under and around plates and binders, and a cinder bed and pair of vent pipes laid to place in the usual way. The hole next was rammed to within 10 inches of the floor level. A facing sand bed now was leveled by two straight edges, and the pattern set to position as shown in Fig. 3. The inlet gates, in cores, were then set to place, and the mold rammed to the parting. As a complete core forming the inside or cope half of the mold had been made previously from the inside of the pattern, the inside now was rammed full of sand and struck off level with the outside joint. A cast-iron cope part, made in one piece from a skeleton frame, next was rammed, holed at suitable places to correspond with the lifting hooks set in the core, staked, hoisted off, and set down out of the way.

Then the pattern was drawn, and several flat pieces of 1-inch lumber, pattern thickness, was laid on the mold face. The core was lowered on these and the cope flask lowered over the mold. Four hook bolts then were attached to the core arbor and screwed tightly to fish plates laid across the flask bars, when the cope and core were hoisted away together to permit the small amount of finishing the drag mold required. As will be seen in the cross section view of

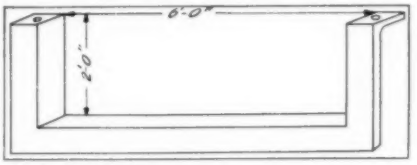


FIG. 2—PIT BINDER CASTING MADE IN OPEN SAND

the assembled mold, shown in Fig. 4, ordinary clamps, embracing the flask and binder flanges, were used to secure the mold when pouring, but for emergencies when making larger castings in the same pit, holes to accommodate inch bolts were provided in the binder flanges, corresponding with slots in the upper and lower flanges on the flask. Tie rods or bolts were used to fasten the flasks to the binders.

This equipment reduced the molding cost of each bed plate by one-third.

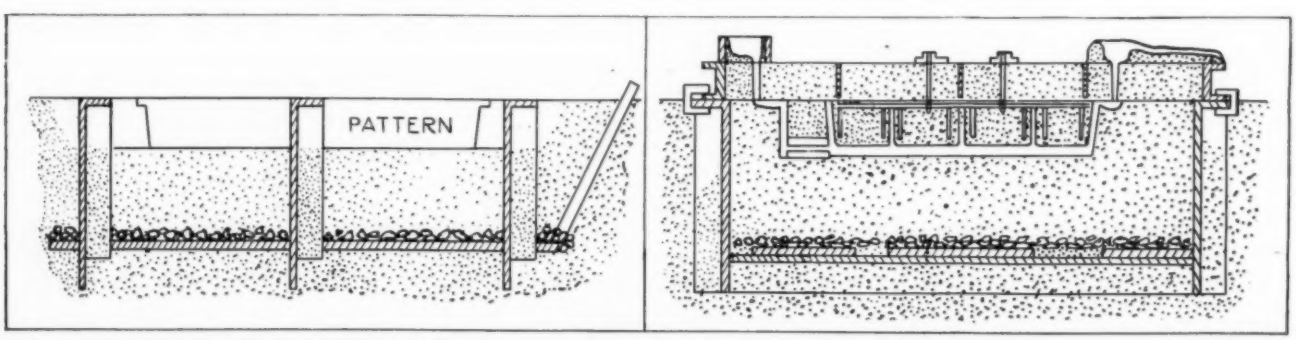


FIG. 3—PIT WITH BINDERS AND PERMANENT CINDER BED LAID—THE PATTERN IS BEDDED IN

FIG. 4—END VIEW OF THE FINISHED MOLD

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

MICROSCOPY OF CAST IRON

(*Continued from Data Sheet No.* 466)

PROGRESSIVE HEAT TINTING ON SAMPLES LOW IN COMBINED CARBON

Micrograph at the right—To first perceptible yellow—Magnification 100 diameters.

Micrograph at the left—To general light brown—Magnification 100 diameters.

(*Continued on Data Sheet No.* 468)

MICROSCOPY OF CAST IRON

(*Continued from Data Sheet No.* 467)

PROGRESSIVE HEAT TINTING ON SAMPLES LOW IN COMBINED CARBON

Micrograph at the left—To dark brown showing purple in spots—Magnification 100 diameters.

Micrograph at the right—Nearly back to metal color again—Magnification 100 diameters.

cost of each bed plate by one-third, and the casting losses from 40 per cent to none on an order of seven besides furnishing a permanent jobbing pit 2 x 5 x 6 feet, large enough to hold almost any casting the two ton crane would lift. A further advantage a pit of this kind possesses, is that it readily may be made longer by the addition of one or more binder castings and the use of longer plates of steel rails to ensure stability.

Study Saves Expense

By M. E. Duggan

When a machine part casting breaks thus shutting down not only the machine itself but in some instances the entire department, the question of supplying a repair part quickly becomes of paramount importance. Usually the manufacturer is located in a distant city and while it is possible that he may have a repair part on hand, it is more probable that he only has a pattern and will have to make a casting and machine it before filling the order. The relative cost of the casting is only a secondary consideration. What the customer wants is speed and therefore looks with favor on a proposal to make his own pattern and casting and do his own machine work. The method he will follow in carrying out the proposition will depend on circumstances. Assuming that a blueprint has been supplied with the machine, it is exhumed from the office files and taken to the pattern shop where the man in charge is instructed to rush a pattern right through. Unless the blueprint has been studied carefully with a view to possible modification in design, this rush order almost invariably is mistaken policy. Many features incorporated in the original design and no doubt considered necessary by the maker, may be omitted on a hurry-up job without detracting in the least from the utilitarian value of the casting. A competent patternmaker quickly may determine where considerable saving may be effected in pattern and foundry expense, but if he is given a blueprint or tracing made from the original drawing in the manufacturers office he has no choice but—to use a printer's term—to follow copy.

If possible the draftsman, the patternmaker and the molder in company should examine both casting and drawing and bearing in mind the purpose for which the casting is intended, cut out all superflous features. Simplify the design by the removal of loose pieces, rounded corners, filleted angles, complicated cored sections. In this manner patterns that under ordinary conditions would remain in the pattern shop 10 or 12 days have been turned out in 3 or 4.

Frequently, where no drawing is available the draftsman is instructed to make one. In the majority of cases he has had experience neither in the foundry or pattern shop and the result of his work is a drawing on a reduced scale with approximately half the dimensions and other information required by the patternmaker missing. Before actually commencing to make the pattern the patternmaker has to lay out a full size drawing on a board and in a great many instances this would be unnecessary if the draftsman had made his drawing full size.

Occasionally it is considered advisable to dispense with a drawing and the broken casting, covered with dirt and grease, is taken directly to the pattern shop, there to serve as a model and inspiration to the patternmaker. The idea is commendable, but considering the character of the work and general conditions prevailing in a pattern shop, the casting should be cleaned thoroughly before it is admitted. The patternmaker is compelled to handle the casting and no mechanic who takes pride in his work cares to find his hands and tools covered with dirty grease. If the pattern presents difficult or complicated features he will find it necessary to lay out one or more full size views on a board and a dirty casting is not conducive to speed, accuracy or a tranquil disposition. Wherever possible it is advisable to send both drawing and broken casting to the pattern shop. My attention was diretced recently to a striking example along the foregoing lines. The original pattern and coreboxes required 14 days to make, one day was spent making the cores and an additional three hours were consumed in fitting a cope to the upper half of a split pattern. The foundryman spent two days making the mold. The pattern for a duplicate repair casting was made in four days. It was molded in the drag, covered with a flat cope and poured on the afternoon of the first day. I don't wish to be understood as advocating that all patterns should be treated in this manner, but in the event of a breakdown or for any other reason where time is the dominant factor a knowledge of short cut methods is an asset. This form of knowledge only can be acquired by the patternmaker through experience.

Contracts for the erection of a new foundry building at W. 69th street and the Wheeling railroad, Cleveland, have been let by the Atlas Foundry Co. The company's existing equipment will be moved into the new plant and added to as improvement in business warrants.

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Contents

	Page
Casts Hub Entirely in Cores	169
Effects of Annealing Gray Iron	177
British Plan Welcome to Foundrymen	180
Safety Meet in Buffalo	180
Selling Goods for Uncle Sam	181
Casts Malleable Chain Links	185
Ceramic Society Discusses Refractories	187
Sinters Magnesite for Metallurgical Use	187
Construction of Coreboxes—II	188
Casting Pure Nickel	192
Size of Sandblast Sand	192
Will Expand Facilities	192
Bill Makes Column Bases in Green Sand	193
Select Sand for Brass Work—II	196
How and Why in Brass Founding	199
Desire High Finished Brass Castings	199
Run Experimental Heats to Find Trouble	199
Permanent Pit Proves Worth	200
Study Saves Expense	201
Sulphur Removal Tedious Process	202
Mouse Traps Lose Their Appeal	202
Trade Outlook in the Foundry Industry	203
Comings and Goings of Foundrymen	204
Urges Foundry Training	204
Seek Cause of Wasters	204
Ohio Foundries Hold Operating average	204
Attack Apprentice Need	204
Old British Foundryman Dies at Dumbarton	205
Present Cast Cup at Iron Mongers Banquet	205
Talks in Philadelphia	205
February Requirements Mount	206
What the Foundries are Doing	207
New Trade Publications	208

Sulphur Removal Tedious Process

CONSIDERABLE interest has been aroused by the report from Germany that a method of reducing the sulphur content of iron by using a ladle addition has been found. While patents have been secured on the mixture used the essential points have been obscured as much as possible, but it appears that the main ingredients are the alkalies with salts of one or more of the alkaline earths, either calcium or barium, more probably the latter. From what is known of the operation of this process it can be concluded that it is effective in removing sulphur from the iron in the ladle to a considerable extent. However, it has drawbacks which are more serious in this country than they would be in European foundries. The mixture must be added in the bottom of the ladle and then as the melted iron is run in on top of it the flux gets in touch with the entire body of iron and absorbs, not only a portion of the sulphur, but what is more important, it is said to free the metal of a large percentage of the gas it contains as it comes from the cupola. Removal of sulphur and gases would be of a great advantage, but would the American foundryman go to the trouble of adding a flux to every ladle, especially when it is necessary to prevent slag entering the ladle with the iron and then to skim off the slag formed by the flux? Possibly in a few cases where the need of low sulphur is particularly essential the flux would be favored, but in general American foundrymen hesitate to the adoption of a method which requires more detail in the process.

Mouse Traps Lose Their Appeal

EMERSON is credited with a famous and widely quoted statement to the effect that if a person makes an article of any kind, even a mousetrap, better than it has been made by any other person, it does not matter if he lives in the midst of a wilderness, the world will beat a pathway to his door.

Even had there been a foundation for the statement in the first place and making all due allowance for the manner in which the statement has persisted—due, of course, in a great measure to the justly-won reputation of the originator—it must be admitted that even as a simile it does not represent actual conditions in this gross, materialistic age. The history of nearly all modern inventions may be quoted to prove this contention. Irrespective of the intrinsic merit of any device the only way to put it across is by systematic, perpetual advertising. The man who erects a large illuminated sign over his front gate and who provides a wide, straight, smooth and easily traveled path plentifully decorated with legible sign posts and extending all the way from the main thoroughfare to his premises, reasonably may expect to have a fighting chance to keep his operating force busy. The man who is content to wait until a clamorous public beats a way to his door eventually will find it necessary to creep out of the jungle that has grown up around him through the extremely narrow and tortuous path provided by the bankruptcy court. Conservatism in business is an admirable trait but it may be carried to extremes and it may not be out of place to suggest that the reading public is blessed with an exceedingly short memory. The modern mouse trap is sold by the million, not because it is better or because mice are more numerous than formerly but because it may be secured for a trifle at the 5 and 10 cent store and every person knows where they are.

Trade Outlook in the Foundry Industry

GRAVE concern is expressed by foundrymen throughout the country over the prospects of a serious labor shortage within a short time. That many, particularly in the smaller cities, find workmen more easy to obtain in winter than in the summer, is evident; while the competition offered for unskilled labor by the high wages paid in the building trades, will become more keen as the season advances. The pinch is felt even in this late winter period, and the shortage of all classes of foundry labor doubtless will become more serious as business continues to improve and other interests attract men away from the sand heap.

Call for More Men

According to the bureau of labor statistics, the number of men employed in foundries and machine shops increased 2.3 per cent in January. This seems to be a small difference over the preceding month, but when this is measured by the actual conditions in individual plants it becomes apparent that the available supply of workmen upon which to draw is limited. One large malleable foundry in northern Ohio desired to put on a night shift. Men could not be found, so colored labor perforce, was imported from the South. A Wisconsin steel foundry, making medium and heavy castings at present could use 100 more men, but it cannot find them, and consequently deliveries are hampered and it is obliged to refuse definite shipment dates on new orders. The effect of the prevailing shortage is remarked by foundry equipment manufacturers. Demand for light squeezer machines to reduce the required number of bench molders is phenomenal, while sales of sand conditioning and other labor saving machinery are growing steadily. Stove shops report that January, February and March, usually their slowest months show unprecedented demand and they cannot find enough molders to keep up with orders received.

Improvement Shown

Foundry business is good and doubtless February will show a marked increase in operations over the preceding month. Building construction has continued throughout the winter, practically without interruption. It is stated that during last year over 50 per cent of the new buildings erected represented dwellings, and that home construction will continue heavy this year. Consequently the demand for building hardware, plumbers goods, sanitary ware and the increasing variety of domestic machinery requiring castings has served to bring a great volume of work to the foundries. Further, the extension of municipal and public service works has drawn heavily upon foundries for cast-iron pipe, soil pipe, fittings, catch basin and manhole castings and numerous other sundries which are furnished by jobbing foundries. In 1922, expenditures for building construction were estimated at five billions of dollars, while authorities state that this year will see the total reach almost six billion dollars. Municipal lettings of cast pipe are increasing and pipemakers are buying iron into the third quarter in expectation of continued heavy demand.

Prices Rising

Castings prices are advancing, and judging from the trend in wages, metal prices and other manufacturing costs, still higher rates may be expected. An important steel foundry in the Pittsburgh district making railway sundries has announced an advance of 10 per cent on all castings effective Feb. 15. The U. S. Radiator Co. has raised its prices on radiators 2½ per cent effective Feb. 12. Light malleable castings have advanced about 10 per cent in the Mid-western districts. With the increasing demand for pig iron, extending into the third quarter, greater strength is shown, although the prices up to the close of February have not been much higher. Scrap prices are slightly advanced, and a shortage is noted in some sections. Coke due to the decreased demand for domestic use is cheaper. The slump was started by widespread railroad embargoes and restriction in consuming points to which the fuel may be shipped. Difficulty still is evident in securing all the coke needed, particularly in the east, and by-product plants are operating at as near to capacity as the available supply of coal will permit. Railroad and automotive demand for castings continue heavy. According to the American Railroad association, the total of freight car orders in January reached 23,022, and that number combined with the unfilled orders of 1922, brings the number to 91,354. Consequently, buying has been limited during the past few weeks, due in part to the inability of car shops to take on more business. Unfilled locomotive orders total 1788.

Prices of Raw Material for Foundry Use

CORRECTED TO FEB. 22

Iron		Scrap	
No. 2 Foundry, Valley	$27.50	Heavy melting steel, valley	$24.00 to 24.50
No. 2 Southern, Birmingham	25.00	Heavy melting steel, Pitts.	24.00 to 24.50
No. 2 Foundry, Chicago	36.00	Heavy melting steel, Chicago	19.75 to 20.00
No. 2 Foundry, Philadelphia	29.13 to 29.26	Stove plate, Chicago	22.75 to 23.75
No. 2 Foundry, Buffalo	28.00	No. 1 cast, Chicago	26.50 to 27.00
Basic, Valley	27.00	No. 1 cast, Philadelphia	24.00 to 25.00
Basic, Buffalo	28.00	No. 1 cast, Birimngham	22.50 to 23.00
Malleable, Chicago	30.00	No. 1 cast, Buffalo	24.00 to 25.00
Malleable, Buffalo	28.50	Car wheels, iron, Pittsburgh	26.00 to 26.50
Coke		Car wheels, iron, Chicago	26.50 to 27.00
Connellsville foundry, coke	8.00 to 8.50	Railroad malleable, Chicago	25.50 to 26.00
Wise county foundry, coke	8.50 to 9.50	Agricultural mal., Chicago	25.50 to 26.00
		Malleable, Buffalo	25.00 to 26.00

Nonferrous Activity

The continuation of heavy demand from automobile makers, coupled with the more than normal requirements for plumbers goods and other brass castings has brought about capacity operation in nonferrous foundries. New York prices on nonferrous metals, according to the *Daily Metal Trade* of Feb. 22, follow: Casting copper, 15.75c; electrolytic copper, 16.00c; straits tin, 43.25c; lead, 8.25c; antimony, 7.25c; aluminum, No. 12 alloy, producers' price, 24.50c and open market, 22.00c; zinc is 7.40c, E. St. Louis, Ill.

Comings and Goings of Foundrymen

HENRY F. RUSSELL has been made treasurer and general manager for the Buffalo Smelting Co., Inc., Buffalo, New York. For the past five years Mr. Russell has been sales manager in the foundry department of Farrar and Trefts, Inc., and previous to that time was connected with the Lumen Bearing Co.

Edward F. Stratton who became general manager of the Sanitary Co. of America, Linfield, Pa., on Jan. 5 has had over 30 years of experience in the foundry and plumbing goods manufacturing lines. He was connected with the Central Foundry Co., New York and later with the Salem Brass & Iron Co., and the Reading Foundry & Supply Co., Reading, Pa. His most recent connection was with Mitchell & Van Meter Co., Linfield, Pa., with which firm he was identified for three years until the latter became associated with the Sanitary Co. of America.

Mark Hawkins has been made foundry foreman for Caskey & Keen, Inc., Philadelphia.

William J. Muhlitner, formerly secretary and manager of the Foundry & Machine Products Co. and the Detroit Foundry Co., Detroit, has been elected secretary and general manager of the Great Lakes Distributing Co., Detroit, miners and shippers of foundry sands, etc.

Gen. Otto H. Falk, president of the Allis-Chalmers Mfg. Co., and vice president of the Falk Corp., Milwaukee, will sail Feb. 20 on a three months' tour of Europe. He will be accompanied by his son.

W. J. Corbett has been engaged by the Electric Steel Founders' Research group as industrial engineer to be associated with R. A. Bull, research director of the group, in the increased activities proposed through expanding the work of the committee on new uses for steel castings. Mr. Corbett's engineering training was supplemented by several years experience in the plants of the American Steel Foundries, also in the steel foundries of the Watertown arsenal and the Erie Forge Co. Mr. Corbett's headquarters will be at the group's central office, 639 Diversey Parkway, Chicago.

Robert W. Rogers, formerly chief metallurgist of the Hudson Motor Car Co., Detroit, now is representing the Halcomb Steel Co., in the Indianapolis and St. Louis territories, having taken over the new work Feb. 13.

Frank H. Howe, president of the Columbus Wire & Iron Works, Columbus, O., has been elected president of the National Association of Ornamental Iron & Bronze Manufacturers to succeed the late H. H. Suydam.

W. Lee Roueche has been appointed works manager for the McWane Cast Iron Pipe Co., Birmingham, Ala. Mr. Roueche resigned his connection with the Crane Co. at its Birmingham, Ala., plant, effective Feb. 15.

Floyd M. Chapman has become affiliated with Dwight P. Robinson & Co., Inc., New York, as consulting materials engineer.

Hugh J. Garvey, vice president of the Valley Mould & Iron Corp., Sharpsville, Pa., has resigned that position, effective March 1, to devote all his time to the Sharpsville Boiler Works Co., Sharpsville, as chairman of the board of directors.

G. M. Leslie, treasurer of the Bass Foundry & Machine Co. and the Fort Wayne Foundry & Machine Co., both of Ft. Wayne, Ind., has been elected president of both companies to succeed the late John H. Bass. C. T. Strawbridge will continue as vice president and L. Heely Link as secretary of the Bass company.

Seek Cause of Wasters

"Defective Castings" formed the subject of a lively meeting of the New England Foundrymen's association at the Exchange club, Boston, Feb. 14. This meeting incidentally ushered in the 1923 officers of the association, and George A. Ray, vice president of Taylor & Fenn Co., Hartford, Conn., took the chair for the first time. The subject was covered by two speakers each talking for thirty-five minutes. V. E. Hillman, metallurgist of Crompton & Knowles Loom Works, Worcester, Mass., presented the first paper and showed with well selected lantern slides the development of modern blast furnace practice, emphasizing features of interest to foundrymen. Following Mr. Hillman, George C. McCormick, assistant metallurgist at Crompton & Knowles Loom Works, gave an intensely practical talk on defective castings. He assumed, for the purpose of discussion, that cupola operation, chemical analysis of the molten metal, and other general features of the foundry were perfect, and then showed how defective castings might still develop through any one of a long list of reasons. Chief of these was molding sand which was too wet. Nearly 150 members of the association from all parts of New England were in attendance.

Urges Foundry Training

At the February meeting and dinner of the Pittsburgh Foundrymen's association, training for foundry executives was urged by Prof. C. C. Leeds, head of the department of machinery production, college of industries, Carnegie Institute of Technology. The gathering was held at the General Forbes hotel and was attended by numerous members and guests of the society. S. B. Cuthbert, of the Carnegie Steel Co., Braddock, Pa., president of the organization, presided.

Attack Apprentice Need

The urgency of recruiting more apprentices to the foundry trade was stressed at the mid-winter meeting of the Newark Foundrymen's association, held Feb. 7. At present, it was said, the ratio of apprentices to the number of molders in the foundries of the Newark district is less than 1 to 20. Leading speakers were A. Trowbridge, of the National Industrial Conference board, New York City. Mr. Fuller of the Seymour vocational school, Newark; and Henry Lane, industrial engineer, Detroit. While no definite program was formulated, a committee was appointed to work out a publicity campaign, this being regarded as highly important, and to endeavor to inaugurate some plan of co-operative training by the different foundries.

Ohio Foundries Hold Operating Average

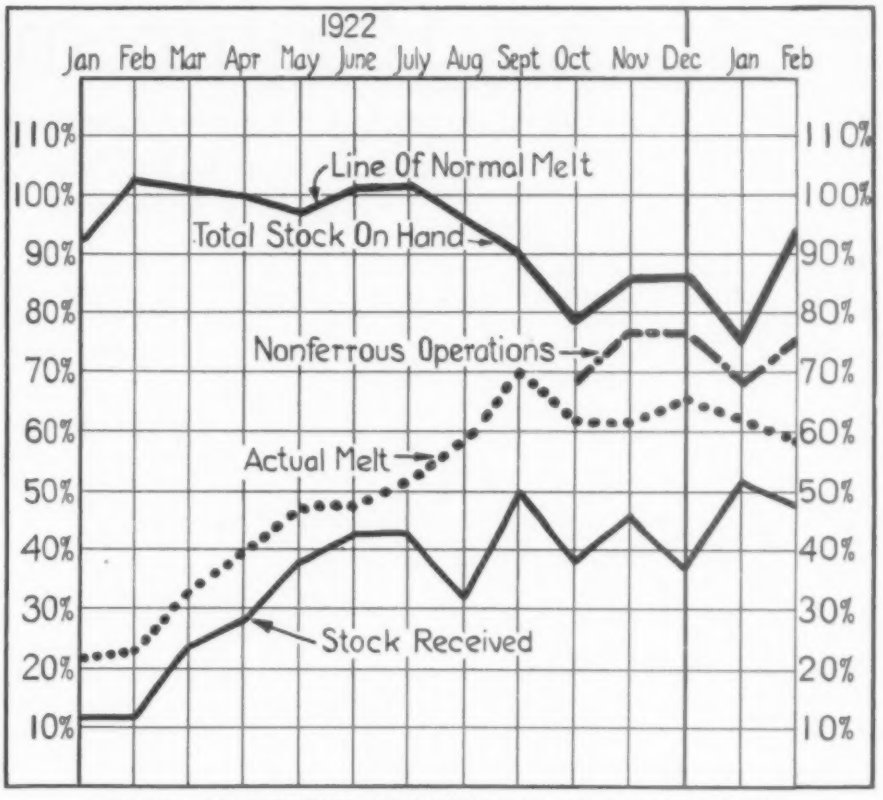
According to statistics prepared by the Ohio State Foundrymen's association and issued through its secretary, A. J. Tuscany, Cleveland, January foundry operations showed a slight loss when compared to the previous month. The December average

is given as 61 per cent, while that for January is 59.34 per cent. However, this latter figure assumes a different significance when compared with the 22 per cent operation for January last year. The accompanying chart illustrates the trend of foundry conditions in Ohio.

The total normal melt for January is indicated as 22,573.8 tons. This figure is equivalent to the 100 per cent figure; the actual tonnage melted was 13,410 tons. This compared with normal melt(22563.8) equals an actual melt. of 59.34 per cent of normal.

The stock on hand shows an increase, the figure for January being 94.1 per cent; this compares with 74.6 per cent for December. This total 21,240.95 tons. This figure, compared with the normal melt figure, 22563.8 tons, is equal to a percentage of 94.1 per cent.

Nonferrous operations show a satisfactory increase, having climbed to 75 per cent of normal for January while for December operations the figure stood 65 per cent—a gain of 10 per cent.



TREND OF FOUNDRY CONDITIONS IN OHIO FOR 1922-1923

Old British Foundryman Dies at Dumbarton

W. Mayer, foundry manager for almost 30 years in the Levenbank foundry of Hardie & Gordon, Dumbarton, Scotland, died in that city on

W. MAYER

Feb. 1 and thereby closed a long and exceedingly active career that began when he started as an apprentice molder with G. Cook & Sons, Washington, County Durham, England. He went into the foundry at a time when it was customary for each molder to tap his own iron from the cupola and when the only light at pouring-off time was furnished by a handful of shavings or the glow from a bull shank of iron. His first foreman's position was with Clark & Chapman, Iron and Brass Founders, Newcastle-On-Tyne, England, and in 1890 he was appointed foundry superintendent at Palmer's, shipbuilders and engineers, Jarrow-on-Tyne. In 1895 he became manager with Hardie & Gordon in the Levenbank foundry and five years later was admitted to partnership in the firm. Mr. Mayer during the greater part of his life maintained a close connection and promoted the interest of the British Foundrymen's association, now chartered as the Institution of British Foundrymen. He served as president of the Scottish branch for one term and was president of the parent association for one year being elected at the London convention June 5, 1915. Mr. Mayer was the donor of a gold chain to remain the property of the association in perpetuity and to be worn by each incoming president upon assuming office. Each successive wearer's name is engraved on one of the links.

Present Cast Cup at Iron Mongers Banquet

Some 50 members of the pig iron fraternity in the Philadelphia district attended the annual banquet of the Iron Mongers association, Tubal Cain chapter, at the Adelphia hotel, that city, Feb. 10. The principal event was the awarding of the so-called Meanley grand challenge cup to the best scorer in the golf tournaments which the association has conducted during the past year. The cup, which went to Walter B. Kennedy, district sales agent for the Bethlehem Steel Co. at Philadelphia, was donated by M. Brooke Meanley, president of the Jones Hollow Ware Co., Baltimore. It is of cast iron, with a gold name plate. It was cast from a heat containing a pig of iron from practically every eastern blast furnace and from several foreign stacks.

Officers elected for the ensuing year were: Iron master, Robert C. Lea; head founder, Richard Peters Jr.; keeper, H. F. Hallman; first helper, Jasper Penny; paymaster, W. S. Barrows, 3rd; clerk, Geo. P. Pilling.

Talks in Philadelphia

E. J. Lowry, Hickman, Williams & Co., addressed the meeting of the Philadelphia Foundrymen's association held at the Manufacturers' club, Feb. 14. His discourse covered metallurgical subjects including chemical elements, mixtures, cupola practice and semisteel and was illustrated by charts explaining points suggested. He explained in detail how carbon is taken up in the cupola.

February Requirements Mount

Inquiry Continues Brisk for Foundry Equipment and Supplies, with a Greater Interest Evident in the East—Light Molding Machinery in Demand

MOLDING machine manufacturers report a steady and increasing demand for equipment. Orders for squeezer machines in particular are active. One firm specializing in light type machines has sufficient business on its books to engage its present capacity for the next sixty days. No one line nor class of castings manufacture is responsible for the present demand. Replacement buying and inquiry for machines for new extensions are prevalent. Last year recorded a fair amount of export business, according to figures recently prepared under direction of W. H. Rastall, chief of the industrial machinery division of the department of commerce. Complete figures for foundry and molding machinery shipped to foreign markets in 1922 follow:

U. S. EXPORTS OF FOUNDRY AND MOLDING MACHINERY

By Months—Calendar Year 1922

Months.	Quantity Lbs.	Value Dollars
January	11,401	4,522
February	127,883	14,230
March	625,831	97,044
April	167,365	35,834
May	170,312	75,887
June	245,505	53,447
July	115,621	28,467
August	248,701	70,228
September	155,776	44,436
October	261,127	41,314
November	329,329	49,368
December	179,875	27,317
Total	2,638,726	342,094

Eastern requirements for equipment are greater than those reported in the middle western states. The Textile Machine Works, Reading, Pa., is considering the advisability of constructing a gray iron foundry to care for its requirements. Ferdinand Thun is secretary-treasurer of the company. The Groeniger Mfg. Co., Columbus, O., is inquiring for a spraying cabinet for enameling work. The Ingersoll Co. has installed at its plant in Painted Post, N. Y., a sand mixer made by the Standard Sand & Machine Co., Cleveland. The Penn Mold & Mfg. Co., Dover, O., has placed a contract with the latter interest to furnish a heavy duty refuse handling system, including magnetic and bucket conveying equipment. F. A. Coleman Co., Cleveland, recently installed a battery of core ovens at the General Bronze Foundry Co. plant in Cleveland, and also has sold miscellaneous equipment, including racks, trucks, etc., to C. & G., Cooper Co., Mt. Vernon, O. The City Brass Foundry Co., Cleveland, and Bonney-Floyd Co., Columbus, O., recently have purchased sand blast equipment from the Pangborn Corp., Hagerstown, Md. The Mayer Fuel Saving Furnace Co., Cleveland, has installed furnaces on existing ovens at the plants of the Elyria Foundry Co., Elyria, O., the Dunham Co., Berea, O., the City Foundry Co., Cleveland, and the Buhl Malleable Co., Detroit. The Burlington Brass Works, Burlington, Wis., has installed a 1500-pound electric furnace. Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., has issued plans for a proposed complete sand handling and conditioning system and miscellaneous conveyors.

High Hopes in Eastern Market

FOUNDRY equipment sellers report demand more active than at any time in recent weeks. Orders for the most part have been confined to single items. Nevertheless, the aggregate volume of business is increasing steadily. Particularly promising at this time is the demand coming out from the railroad shops and foundries engaged in car and locomotive building and repair work. Several companies engaged in this work in this district the past couple of weeks have been buyers, including the American Locomotive Co. This company now is inquiring for 300 tons of steel for an addition to its plant at Paterson, N. J., but whether any foundry equipment will be required, cannot at present be ascertained. The Central Foundry Co., with headquarters in New York city, recently has purchased two large Whiting cupolas from the former plant of the American Brake Shoe & Foundry Co., Newark, N. J. One of these is understood to be for its plant in Newark and the other for a new foundry to be erected in Holt, Ala. Considerable equipment will be required for this latter project, but as yet no list has been issued. Other buyers of foundry equipment in this district are the General Fire Extinguisher Co., Auburn, R. I., the Saco Lowell Shops, Lowell, Mass., and the Gleason Works, Rochester, N. Y., all having recently bought mixers from the National Engineering Co., Chicago. The New York Central railroad is understood to be figuring tentatively on some foundry equipment for its Frankfort shops. Eastern Steel Castings, Newark, N. J., has closed on two 10-ton electric overhead cranes to the Pawling & Harnischfeger Co., Milwaukee and one 6-ton, 1-motor crane, 18-foot span to the Hoist & Crane Engineering Co. Inquiries are being received by crane sellers in this district for a used 10-ton electric gantry crane, with 60-foot span, for interior operation in the foundry of the Woodward Iron Co., Woodward, Ala. The Lancaster Iron Works, Lancaster, Pa., has closed on a 15-ton electric overhead crane, to Alfred Box & Co., and the Baldwin Locomotive Works, Philadelphia, on two 40-ton electric cranes for a tender shop, to the Milwaukee Electric Crane & Mfg. Co., Milwaukee. The Ajax Iron Works, Corry, Pa., has closed on a 5-ton electric crane with 30-foot span, to the Northern Engineering Works, Detroit. H. B. Smith Co., Westfield, Mass., has purchased sand blast equipment from the Pangborn Corp., Hagerstown, Md.

Occasional Inquiry Strong in Pittsburgh

INTERMITTENT buying continues in the foundry equipment market in the Pittsburgh territory and based on the number of inquiries which still are current this promises to be the case for some time to come. More and more of a tendency is seen among users to send orders direct to equipment manufacturers instead of dealing through middle interests. For instance, a few equipment sellers were expecting a share of the orders placed

direct with a Philadelphia manufacturer by the Blackwood Electric Steel Corp., Parkersburg, W. Va. Some additional machinery is to be bought later by the Blackwood company. The Westinghouse Electric & Mfg. Co., however, has an order from a Pittsburgh dealer for one sand mixer for its East Springfield, Mass., plant. This dealer likewise has received an order from the Pressed Steel Car Co. for a 35-inch cupola and a cupola lining. The same seller recently disposed of a fair number of cast iron flasks, ladles, riddles, etc., together with about $400 worth of core machine parts, and has just received notice that it is the successful bidder upon a complete output for a new foundry at the United States boat yard, West Monessen, Pa. This order will include a small brass furnace, cupola, tumbling mill, magnetic separator, together with flasks, shovels, riddles, brushes, facings, core compound, oil, etc. Several foundry interests in the Pittsburgh district continue to buy steel flasks from a Youngstown, O., maker from time to time. E. H. Williams, Latrobe, Pa., is said to be in the market for ingot mold making machinery of various kinds, the inquiry coming from the Vulcan Mold & Foundry Co., Latrobe, Pa. The Berkeley Machine Works & Foundry Co., Norfolk, Va., and the Berks Foundry & Mfg. Co., Hamburg, Pa., are installing modern machinery and foundry equipment of various kinds. Molding machine inquiries again are on the increase and several sales are noted by leading builders in this section. Inquiries for cranes, hoists and heavy equipment of that type recently have been heavy from various foundries. The Lancaster Steel Products Co., Lancaster, Pa., took bids on three 2-ton, 3-motor traveling cranes with 30-foot span. The Ingersoll-Rand Co., Painted Post, N. Y., closed on one each 10 and 25-ton cranes with the Pawling & Harnischfeger Co., Milwaukee. The Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., took an order for one 10-ton electric crane with 27-foot span from the Darling Pump & Mfg. Co., Williamsport, Pa. Included among recent orders for molding machines coming to the Herman Pneumatic Machine Co., Zelienople, Pa., are the following: One large rollover machine for the American Locomotive Works, Richmond, Va.; William Sellers & Co., Inc., Philadelphia, one of the same type; two each for the Benedict Stone Corp., Tuckahoe, N. Y., and the National Supply Co., Toledo, O. for Cleveland plant; one each for the Queen's City Foundry Co., Denver, Col., the Buckeye Mfg. & Foundry Co., Overpeck, O., and the Florence Pipe Foundry & Machine Co., Florence, N. J., the last being a jar stripper. The American Radiator Co., ordered two for its Buffalo plant and one for its Detroit plant while the Commercial Steel Castings Co., Marion, O., ordered a plain jarring machine.

Future Requirements Lead in the West

SOME falling off is noted in demand for foundry equipment at the moment, though inquiry keeps up and quotations are being made on a large volume of business. Though there is a smaller buying movement much business continues to be placed in ladles, trucks and smaller equipment, while cupolas and tumblers are being covered. Manufacturers of equipment are behind and welcome the lull as an opportunity to clean up some of their orders. Difficulty in obtaining steel plates for cupolas and tumblers in the present slow condition of delivery by mills is adding to the delay in filling orders. The Whiting Corp., Harvey, Ill., has sold two 36 x 72-inch tumbling barrels to Hiram Walker & Son, Walkerville, Ont., a 27-inch cupola to the Electric Controller & Mfg. Co., Cleveland, a 72-inch cupola to the Westinghouse Air Brake Co., Wilmerding, Pa., a 16-ton handpower crane to the Westinghouse Electric & Mfg. Co., Philadelphia, and eight 33 x 80-inch tumbling barrels to the Buick Co., Flint, Mich. Engineers have numerous propositions on their boards for new foundries and for additions and rearrangements of existing plants. In some cases these are being held back to determine the future course of business before making the investment. The Iowa Malleable Iron Co., Fairfield, Ia., has contracted with the Pangborn Corp., Hagerstown, Md., for sand-blast equipment.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

The Imperial Pipe Foundry, Bessemer, Ala., plans extensions to its plant.

A modern factory building will be erected by the Galion Iron Works, Galion, O.

The foundry at the plant of the Hazen Mfg. Co., Hudson, O., recently was damaged by fire.

Erection of a 2-story building, 35 x 70 feet, is planned by the Erie Foundry Co., Erie, Pa.

The plant of the Union Steel Casting Co., Pittsburgh, recently was damaged by fire.

The Weir Stove Co., Taunton, Mass., has let the contract for the erection of an addition to its plant, 77 x 115 feet.

The plant of the American Steel Foundries at Indiana Harbor, Ind., recently was damaged by fire.

The Ohio State Stove & Mfg. Co., Columbus, O., plans the erection of a factory building, 32 x 90 feet.

The Water Valley Foundry Co., Water Valley, N. Y., plans to rebuild its plant recently damaged by fire.

The plant of Sidney C. McLouth Foundry, Marine City, Mich., was badly damaged by fire, Wednesday morning, Feb. 21.

J. T. Tice and R. J. Higginbotham plan to establish a foundry at Cedartown, Ga., to be known as the J. T. Tice Co.

The Ontario Malleable Iron Co., Guelph, Ont., has purchased a site on which it plans the erection of a plant addition.

The Dallas Brass Mfg. Co., Dallas, Tex., plans the erection of a 1-story plant addition, 50 x 100 feet.

A 1-story frame building at the plant of the Allyne-Ryan Foundry Co., Cleveland, recently was damaged by fire.

Erection of a plant addition is planned by the Manistique Brass & Bronze Co., Manistique, Mich.

The Birmingham Machine & Foundry Co., Birmingham, Ala., has broken ground for the erection of a plant addition.

Capitalized at $25,000, the Reliance Foundry Co., Slinger, Wis., recently was incorporated by Frank R. Herman, John Wevers and James H. Wilkins.

The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., is understood to have let a contract for a 2-story plant addition, 55 x 120 feet.

The Brazil Machine & Foundry Co., Brazil, Ind., recently was damaged by fire. The company manufactures clay-working machinery and meter boxes.

Plans to rebuild its plant, which recently was damaged by fire, are being prepared by the Unique Brass Mfg. Co., 123 Military avenue, Detroit.

Capitalized at $25,000 the Oakland Foundry & Machine Co., Rochester, Mich., has been incorporated by Edward F. Striker. Will Becht, Henry Albright and others.

Plans are being prepared by the United States Cast Iron Pipe & Foundry Co., for the erection of an addition to its plant at Burlington, N. J.

Erection of a modern foundry building at West Seventy-third street and Denison avenue, Cleveland, is planned by the Atlas Foundry Co., Shaw avenue, that city.

Capitalized at $15,000 the Vancouver Foundry & Machinery Co., Vancouver, Wash., recently was incorporated by Edward Rohrer, Charles W. Hall and J. B. Atkinson.

The Consolidated Art Metal Foundry, New York, has been incorporated with $10,000 capital stock by M. E. Einhorn and R. L. White.

The company is represented by W. Post, 50 Church street, New York.

The Tennessee Coal, Iron & Railroad Co., Birmingham, Ala., is contemplating the construction of a new steel and gray iron foundry at Ensley, Ala.

The New Haven Gray Iron Works, Detroit, has been incorporated with $15,000 capital stock to engage in general foundry work by Jay Baldwin, New Haven, Mich., and others.

Capitalized at $20,000 the Montague Castings Co., Montague, Mich., has been organized to engage in general foundry work by John Reed, Whitehall, Mich., and others.

The Great Western Stove Co., Leavenworth, Kans., has awarded a contract to the Baer Engineering & Construction Co. for the erection of a plant building.

The Sterling Brass Products Co., Worcester, Mass., has been incorporated to operate a foundry with $50,000 capital stock by Herman Stake, Peter F. Riordan and John C. Mahoney.

The Northwestern Foundry Co., 662 West Roosevelt road, Chicago, has started to rebuild its foundry which recently was damaged by fire. The structure will be 51 x 126 feet.

The Anderson Pattern Works, Erie, Pa., has been incorporated with $16,000 capital stock to manufacture wood and metal patterns, by F. F. Anderson, Robert A. Dugan and C. H. Anderson.

Plans now are being made by the Boston Stove Foundry Co., 202-210 Border street, East Boston, Mass., to move into its new plant in Reading, Mass., about May 1. The company will continue the manufacture of ranges.

Work will begin about March 1 on the erection of a foundry for the Studebaker Corp., at South Bend, Ind. The building will be of concrete and steel, one story, 650 x 720 feet. The foundry will have a capacity of 750 complete sets of automobile castings per day.

Word has been received from the Jamestown Iron Works Co., Jamestown, N. Y., to the effect that it does not plan to rebuild its machine shop which was damaged by fire some time ago. However, it is continuing its foundry business as heretofore, none of its foundry buildings or equipment being damaged by the fire.

The Ackermite Co. of America, manufacturer of bearing and packing metal, has removed its general offices, laboratory and foundry to its new plant at 3223 South Western boulevard, Chicago. The new plant will give the company a productive capacity of more than 100,000 pounds daily. A. H. Ackerman is vice president.

Plans now are being drawn for the erection of a foundry on Lansdown street, Cambridge, Mass., for W. T. Royce, former superintendent of the Mead-Morrison Mfg. Co., Boston, and associates. Ground for the erection of the building will be broken just as soon as the plans are completed, which is expected within 60 days. It is expected the plant will start on the production of brass and aluminum castings but later on will add iron.

Employment of female help in the coreroom has proved so satisfactory that the Western Malleable Co., Beaver Dam, Wis., is building a coreroom, 38 x 58 feet, to be used only by girls and women engaged in this work. At present about 20 girls are doing piece work alongside men but it is intended to engage from 40 to 60 more women, so that separate working quarters are being provided. The new coreroom is an addition to the South street foundry, one of three shops operated by the Western company in Beaver Dam.

The France Foundry & Machine Co. has bought the machinery, patterns and patents of the Charles Went Co., Findlay, O., and is moving the property to its plant at North Baltimore, O. The Went Co. has been in business in Findlay for 50 years. This additional equipment in the France plant will make it the largest machine shop for heavy work between Toledo and Columbus. All repair work of the France quarries in northwestern Ohio will be done here. The main office of the company will remain in Toledo, O.

John Service Co., of Milwaukee, manufacturer of automatic heat regulating appliances and conducting a brass foundry and machine shop, is preparing to erect an addition to its plant at Jefferson and Michigan streets, Milwaukee, which will duplicate its present quarters. According to Harry W. Ellis, president and general manager, the construction will await the action of the Wisconsin legislature with reference to taxation bills now under consideration. The proposed enlargement contemplates an expenditure of from $50,000 to $300,000 in building, machinery and general equipment.

Fire recently damaged the foundry and machine shops of the Gilson Co., Port Washington, Wis. The japanning building, boiler house, a large warehouse, smaller building were gutted and the shop badly damaged. The gray iron shop was saved. Another warehouse, 100 x 200 feet, is being put into shape for use as a machine shop. The Gilson company has large orders for chair and furniture castings as well as gas engines, power truck garden cultivators, etc. Plans for rebuilding the damaged structures are under way. Harry W. Bolens is president and general manager of the company.

New Trade Publications

SAND CUTTING MACHINE.—The American Foundry Equipment Co., New York, has published a 12-page illustrated folder in which a power sand cutting machine is described and illustrated. This machine is built upon a frame of seamless steel tubing. The front wheels are of caster type mounted in inclined forks. The drive wheels are of tractor type and are motor driven through a differential shaft with spur pinion at each end, engaging with a ring gear on each tractor wheel. The motor runs forward or reverses, and at high or low speed. The cutting cylinder, shield, motor and transmission are carried upon an approximately balanced frame. By tilting this frame backward the steel cutting cylinder is lowered into the sand and vice versa. Raising and lowering is by a hand wheel at the front of the machine. Other details of construction are pointed out.

PULVERIZED COAL SYSTEMS—The Bonnot Co., Canton, O., has published a 12-page illustrated booklet in which a pulverized coal system is described and illustrated. This system, according to the booklet, is being used successfully in operating air melting furnaces, annealing ovens, sheet and pair furnaces, forge furnaces, copper smelters, billet heating, steam boilers, etc. The information given and the illustrations are interesting and valuable.

RIVET BUSTER.—A 4-page illustrated folder has been published by the Independent Pneumatic Tool Co., Chicago, in which a pneumatic safety rivet buster is described and illustrated. This tool will cut off and back out rivets of all sizes. In addition it drives and is provided with quick changeable safety retainer. It is changed from a chisel to a backing-out punch by turning retainer one-quarter. It can be operated in close quarters, and weighs but 27 pounds complete. Full specifications of the tool are given.

AIR FILTERS—The Midwest Steel & Supply Co., Inc., New York, is circulating an illustrated folder in which several types of air filters are described and illustrated. The use and healthful advantages of these filters are pointed out, as well as their wide field of application.

VISES—The Atlas Vise Co., Inc., Lowville, N. Y., has published an illustrated circular in which a combination machinist and pipe fitters' vise, with swivel base, anvil and shear, is described and illustrated.

MOTORS—An illustrated bulletin has been published by the American Electric Motors, Inc., Milwaukee, in which the electric motors are described and illustrated. Construction details are given. These motors are of the enclosed ball-bearing, self-ventilated, polyphase induction type and they are said to be adapted for use in foundries, flour and grist mills, grain elevators, woodworking plants, etc.

MOLDING MACHINES—The Osborn Mfg. Co., Inc., Cleveland, has published a 62-page illustrated booklet in which machines for jolting, rolling-over, flask-stripping, pattern drawing and squeezing are described and illustrated. These machines are for use in steel, malleable, gray iron, brass and aluminum foundries.

SERVICE—The Combustion Engineering Corp., New York, has issued a "Service Bulletin," in which the stoker manufacturer's side of the service question is presented. It is illustrated with an interesting cartoon story.

LADLES—A 32-page illustrated booklet has been published by the J. W. Paxson Co., Philadelphia, in which foundry ladles are described and illustrated. The bowls of these ladles are of heavy steel plates, designed for strength and stiffness, machine riveted to flanged steel heads. The bowls have forged lips up to 400 pounds capacity, and have vent holes in the sides and bottom to carry off gases. Gearing is standard on all stock ladles and is of the improved worm and worm wheel type reduced through bevel gears to handwheel. Other details of construction and design are given.

CUPOLA TAPPER—The Medart Co., St. Louis, has published a 4-page folder in which a safety cupola tapper and stopper is described and illustrated. According to the folder the use of this device eliminates the use of the hinged spout and prevents the accident of one ladle not following another quickly enough to prevent the reservoir spout overflowing.

FURNACE LINING—A 4-page illustrated folder has been published by the Quigley Furnace Specialties Co., Inc., New York, in which boiler economies effected through the use of proper furnace linings is pointed out.

MILLS—A 32-page illustrated booklet has been published by the Hardinge Co., New York, in which conical ball and pebble mills are described and illustrated and their application to the field of grinding and pulverizing pointed out. Both the ball and pebble mills are of similar construction, the only difference being that the ball mill in the larger sizes is designed to withstand heavier loads and has a different type of lining. Material ground in these mills include abrasive, aluminum dross, anthracite coal, asbestos rock, carbide, cement clinker, chalk, charcoal, chemicals, ores, coke iron borings, pigments and numerous other materials.